

## **REVIEW ARTICLE**

# **The Roles of Information Communication Technologies in Education Review Article with Emphasis to the Computer and Internet**

**Fisseha Mikre**

### **Abstract**

*This article discusses the Roles of ICT in education. Information communication technologies (ICT) at present are influencing every aspect of human life. They are playing salient roles in work places, business, education, and entertainment. Moreover, many people recognize ICTs as catalysts for change; change in working conditions, handling and exchanging information, teaching methods, learning approaches, scientific research, and in accessing information. Therefore, this review article discusses the roles of ICTs, the promises, limitations and key challenges of integration to education systems. The review attempts in answering the following questions: (1) What are the benefits of ICTs in education? (2) What are the existing promises of ICT use in education systems of some developing countries? (3) What are the limitations and key challenges of ICTs integration to education systems? The review concludes that regardless of all the limitations characterizing it, ICT benefits education systems to provide quality education in alignment with constructivism, which is a contemporary paradigm of learning.*

### **INTRODUCTION**

ICTs are making dynamic changes in society. They are influencing all aspects of life. The influences are felt more and more at schools. Because ICTs provide both students and teachers with more opportunities in adapting learning and teaching to individual needs, society is, forcing schools aptly respond to this

technical innovation. Tinio (2002), states the potentials of ICTs in increasing access and improving relevance and quality of education in developing countries. Tinio further states the potentials of ICT as follows:

ICTs greatly facilitate the acquisition and absorption of knowledge, offering developing countries unprecedented opportunities to enhance educational systems,

---

**By: Fisseha Mikre (Lecturer, Department of Psychology)**

*Last submitted 28 July 2011*

improve policy formulation and execution, and widen the range of opportunities for business and the poor. One of the greatest hardships endured by the poor, and by many others, who live in the poorest countries, in their sense of isolation, and ICTs can open access to knowledge in ways unimaginable not long ago.

In Watson's (2001) description, ICTs have revolutionized the way people work today and are now transforming education systems. As a result, if schools train children in yesterday's skills and technologies they may not be effective and fit in tomorrow's world. This is a sufficient reason for ICTs to win global recognition and attention. For instance, ICTs are dependable tools in facilitating the attainment of one of the Millennium Development Goals (MDGs), which is achievement of universal primary education by the year 2015. Kofi Anan, the former United Nations Secretary General, points out that in order to attain the goal of Universal Primary Education by the year 2015; we must ensure that information and communication technologies (ICTs) unlock the door of education systems. This indicates the growing demand and increasingly important place that (ICTs) could receive in education. Since ICTs provide greater opportunity for students and teachers to adjust learning and teaching to individual needs, society is, forcing schools to give appropriate response to this technical innovation.

Even though ICTs play significant roles in representing equalization strategy for developing countries, the reality of the digital divide- the gap between those who have access to, and control technology and those who do not, make a huge difference

in the use of ICTs. This means, that the introduction and integration of ICTs at different levels and various types of education is the most challenging undertaking. Failure to meet the challenges would mean a further widening of the knowledge gap and deepening of existing economic and social inequalities among the developed and the developing countries. Thus, the purpose of this review article is to discuss the benefits of ICT use in education, in the enhancement of student learning and experiences of some countries in order to encourage policy makers, school administrators, and teachers pay the required attention to integrate this technology in their education systems. In so doing, it highlights the benefits of ICT in education, existing promises, and the limitations and challenges of integration to education systems.

#### **Operational definition of terms**

**Information Communication Technologies (ICT)** in this review article refers to the computer and internet connections used to handle and communicate information for learning purpose.

**E learning:** - is a learning program that makes use of an information network- such as the internet, an intranet (LAN) or extranet (WAN) whether wholly or in part, for course delivery, interaction and/or facilitation. Web-based learning is a subset of e learning and refers to learning using an internet browser such as the moodle, blackboard or internet explorer (Tinio, 2002).

**Blended Learning:** - refers to learning models that combines the face-to-face classroom practice with e-learning solutions. For example, a teacher may facilitate student learning in class contact and uses the moodle (modular object

oriented dynamic learning environment) to facilitate out of class learning.

**Constructivism:** - is a paradigm of learning that assumes learning as a process individuals "construct" meaning or new knowledge based on their prior knowledge and experience (Johassen, 1991). Educators also call it the emerging pedagogy in contrast to the long existing behaviourism view of learning.

**Learner- centred learning environment:** - is a learning environment that pays attention to knowledge, skills, attitudes, and beliefs that learners bring with them to the learning process where its impetus is derived from a paradigm of learning called constructivism. In the context of this article, it means students personal engagement to the learning task using the computer and or the internet connection.

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

The uses of ICT is making major differences in the learning of students and teaching approaches. Schools in the Western World invested a lot for ICT infrastructures over the last 20 years, and students use computers more often and for a much larger range of applications (Volman, 2005). Several studies reveal that students using ICT facilities mostly show higher learning gains than those who do not use. For instance, Kulik's (1994) finding across 75 studies in the United States showed the following.

Students who used computer tutorials in mathematics, natural science, and social science score significantly higher on tests in these subjects. Students who used simulation software in science also scored higher. The findings also indicated that primary school students who used tutorial software in reading scored significantly higher on reading

scores. Very young students who used computers to write their own stories scored significantly higher on measures of reading skill. Moreover, students who used word processors or otherwise used the computer for writing scored higher on measures of writing skill.

Furthermore, the use of ICTs in education also shifts the learning approaches. As put by (Bransford, Brown, and Cocking, 1999) cited in Volman (2005), there is a common belief that the use of ICTs in education contributes to a more constructivist learning and an increase in activity and greater responsibility of students. This limits the role of the teacher to supporting, advising, and coaching students rather than merely transmitting knowledge. The gradual progress in using computers changes from learning about computers, to learning computers, and finally to learning with computers (Volman, 2005). With respect to introducing ICT technologies in schools, Olson (2000) advises to explore the following questions as bases for in-service teacher education. These are (1) how can the theoretical ideas tested in practice? (2) What does practice say back to these theoretical ideas? (3) How is useful negative feedbacks obtained? (4) What might be substantive talking points about the new processes? What is practical from a classroom perspective? (5) What does talking about the new say about the nature of existing technology? Is it adequate? (6) What scaffold needs for the next stage?

On the other hand, teachers' reluctance to adopt innovations need to be seen in the context of existing technology and commitments. Fullen (1989) cited in Watson (2001) states that change or improvement can happen at schools if teachers understand themselves and understood by others. For instance, many teachers are currently not in a position to

make informed judgements on ICTs to support their teaching goals. Clearly a variety of factors still do make using ICT in the curriculum problematic (Watson, 2001). Because of this, the influence of ICT did not bring revolutionary changes at schools. For instance, the National ICT survey in the Netherlands shows that most primary-school students use computers less than once a week and there are still many secondary school teachers who do not use ICT at all (Volman, 2005). Most often, they use computers for drill-and-practice and word processing.

In recent years however, there has been a growing interest to know how computers and internet can best utilized to improve effectiveness and efficiency of education at all levels and in both formal and non-formal settings. As there is a shift of theories explaining learning processes, ICTs become handmaiden for learning activities. Voogt's (2003) description on the major roles, distinguished ICTs as an object for study, an aspect of a discipline or a profession, and a medium of instruction. As a medium of instruction, ICTs fit to realize and implement the emerging pedagogy of constructivism (Davis, 1997; Office of Technology Assessment, 1995; Panel on Educational Technology, 1997; Watson, 1996) in Voogt (2003). Moreover, Voogt (2003) differentiated between traditional learning setting and constructivist approaches. The former considers learning as transmission of knowledge to students,

which is the sole responsibility of the teacher. On the other hand, the constructivist approach considers learning as authentic and learner centred. ICT, the computer for example is a great help in the constructivist approach, where one can design simulated and individualized learning environments to students.

ICTs are exerting impacts on pedagogical approaches in the classrooms. Their contribution to changes in teaching practices, school innovation, and community services is considerable. A research review by Kozma (2005) suggests three significant concerns of consideration regarding ICTs impact on education. Firstly, student outcomes such as higher scores in school subjects or the learning of entirely new skills needed for a developing economy. Secondly, we should consider teacher and classroom outcomes such as development of teachers' technology skills and knowledge of new pedagogic approaches as well as improved attitudes toward teaching. Finally, one has to consider other outcomes such as increased innovativeness in schools and access of community members to adult education and literacy. The table below presents comparison of the traditional pedagogy and the emerging pedagogy of constructivism that fits to the use of ICT (particularly the computer and internet) to increase student involvement in learning. Emerging pedagogy is the name given to the new view of constructivist learning when compared to the relatively long existing behaviourist view of learning.

**Overview of Pedagogy in the Traditional versus Information Society** As adapted by Voogt (2003) from (Voogt & Odenthal, 1997; Wijnen et.al., 1999)

Aspect	Traditional pedagogy	Emerging pedagogy for the information society
Active learning	Activities prescribed by teacher	Activities determined by learners
	Whole class instruction	Small group
	Little variation activities	Many different activities
	Pace determined by the programme	Pace determined by learners
Collaborative	Individual	Working in teams
	Homogenous groups	Heterogeneous groups
	Every one for him/herself	Supporting each other
Creative	Reproductive learning	Productive learning
	Apply known solutions to problems	Find new solutions to problems
Integrative	No link between theory and practice	Integrating theory and practice
	Separate subjects	integration between subjects
	Discipline based	Thematic
	Individual teachers	Teams of teachers
Evaluative	Traditional pedagogy	Emerging pedagogy for the information society

*Tinio (2002) describes each of the pedagogic aspects in the table above in terms of implication for ICT use as follows.*

**Active learning:** - ICT-enhanced learning mobilizes tools for examination, calculation and analysis of information in order to provide a platform for student inquiry, analysis and construction of new information. The learners therefore, learn as they do and, whenever appropriate work on real-life problems in-depth. Moreover, ICT makes the learning less abstract and more relevant to their life situations. In contrast to memorization-based or rote learning, that is the feature of traditional pedagogy; ICT-enhanced learning promotes increased learner engagement. ICT-enhanced learning can also be ‘just-in-time’ learning that the learners choose what to learn when they need.

**Collaborative learning:** - ICT-supported learning encourages interaction and cooperation among students, teachers, and experts regardless of where they are. Apart from modelling real world interactions, ICT-supported learning provides

opportunity to work with students from different cultures, thereby helping to enhance learners teaming and communication skills as well as their global awareness. It models learning done throughout the learner’s lifetime by expanding the learning pace to include not just peers but also mentors and experts from different fields.

**Creative learning:** - ICT-supported learning promotes the manipulation of existing information and the creation of real-world products rather than the duplication of received information.

**Integrative learning:** - ICT-enhanced learning promotes a thematic integrative approach to teaching and learning. This approach eliminates the artificial separation between the different disciplines and between theory and practice, which characterizes the traditional approach.

**Evaluative learning:** - ICT-enhanced learning is student-directed and diagnostic. Unlike static, text or print-based education, ICT-enhanced learning recognizes the presence of different learning pathways to explore and discover rather than merely listen and remember.

The discussion above clearly elaborates the role of ICTs in facilitating the pedagogy of schools in the information society. As put by (Davis, 1997; Office of Technology Assessment, 1995; panel of Education Technology, 1997; Watson, 1996) in Voogt (2003), ICT is becoming more fitting to realize and implement the emerging pedagogy of constructivism. Nevertheless, an International study by Pelgrum and Anderson (1999) in Voogt (2003) shows a major obstacle for ICT integration in education and that is the difficulty of integrating computers and internet into classroom practices. Teachers' lack of competence and enthusiasm to use computers in the instructional processes also contribute for the difficulty. However, in order to improve, and make optimal use of ICTs, changes in the pedagogic approaches and classroom strategies as well as integrating ICT in teacher training and staff development practices accompanied by teacher motivation schemes are imperative.

Generally, Voogt (2003) describes the following functions of ICT in education.

ICT as object. It refers to learning about ICT. Mostly organized in a specific course. What is being learned depends on the type of education and the level of the students? Education prepares students for the use of ICT in education, future occupation, and social life.

- ICT as an 'assisting tool'. ICT is used as a tool, for example while making

assignments, collecting data and documentation, communicating, and conducting research. Typically, ICT is used independently from the subject matter.

- ICT as a medium for teaching and learning. This refers to ICT as a tool for teaching and learning itself, the medium through which teachers can teach and learners can learn. It appears in many different forms, such as drill and practice exercises, in simulations and educational networks.
- ICT as a tool for organization and management in schools.

### **Examples of ICT use in Education Systems of Developed Countries**

Most of the developed countries have applied ICTs in the 1980s to the level of K-12 education for a variety of reasons, which are still valid. Some of the reasons as discussed by Pedro and et.al (2004), are as follows:

#### **A new society requires new skills**

ICTs increasingly pervade every aspect of life (work, learning, leisure, and health). Because ICTs are excellent tools for information processing, the new generation needs to become competent in their use, should acquire the necessary skills, and therefore must have access to computers and networks while at school (Kok, 2007). Schools are information and knowledge holding institutions. Therefore, ICT should be fundamental information management tool at all levels of an educational system, from classroom to ministries.

#### **A Quest for Quality learning**

Schools should profoundly revise present teaching practices and resources to create effective learning environments and improve life-long learning skills and habits in their students. ICTs are versatile, and

powerful tools that can help in this purpose and should therefore present in every

classroom, library and teacher room. Nevertheless, so far ICT have not provided any large-scale breakthrough in learning improvements even though there are still promises with great potential.

Developed nations are using ICT in their education systems. For instance, in the United Kingdom, 'rising of standards' of teaching and learning has become intertwined with the use of ICTs (Watson, 2001). As the UK Minister for Education and Employment states, using digital technology for improving the delivery of education has enormous potential to raise standards and increase employability. To realize this, number of computers in schools increased time after time. "In 1980 an initiative placed one computer in every secondary school; two years later there were 16. In 1990, the average number of pupils per computer in secondary schools was 18; by 1998, it was eight. The Minister refers to this "moving schools into an information age" As Watson (2001: 253) puts it:

**We are world leaders in ICT at schools, recognizing its vital importance to the future of all pupils. The figures show clearly the advances**

**we have made in the field. It is an investment, not only in our children and in their lives in the 21<sup>st</sup> century, but in our country's future as well.**

The use of computers at an early age helps students learn ICT skills that help as tools in the education process. For example, 77% of Swiss students reported using a computer several times a week to prepare their courses and assignments. Only 3% reported never using a computer for course preparation. As indicated in the OECD

(2002) document, the average number of students per computer is an indicator of

students' accesses to new technologies. As some data from OECD (2002) shows, the percentage of students with access to computer varies from 25% in Italy to 90% or more in Canada, Finland, and New Zealand. Computer use also varies between students of primary and secondary schools; where the later generally having greater access. In recent years, the number of students per computer has been decreasing in the countries mentioned above.

### **Implications of ICT-Enhanced Education for Policy and Planning**

There is a common belief that ICTs have significant contributions to changes in teaching practices, school change and innovations, and community services. Thus, policy makers and project leaders should think in terms of input factors that can work together to observe the right impact of ICT in education. Matching the introduction of computers with national policies and programs related to changes in curriculum, pedagogy, assessment, and teacher training is more likely to result in greater learning of students and other outcomes (Kozma, 2005). OECD's international survey (2002) of upper secondary schools in 17 countries reveals computer availability for students; use of ICTs by teachers; ICTs activities as a part

of student assignment; the role of ICTs in teaching and learning; staff development; co-operation with other schools and organizations; and obstacle to using ICTs in schools and found great variations among the countries with respect to the mentioned variables.

OECD's Education Committee meeting for instance endorsed a proposal for a new activity on ICT known as "Policy Challenges for Education". The meeting

intended to identify and evaluate what education policy makers might do to better

development of instructional content-ware remains a neglected area, affecting

use ICTs in achieving improved educational outcomes. As cited in the OECD Planning Meeting Agenda and Issue Paper (2002: 3), the structure of activity focuses on two broad and related questions as follows:

1. What policies are required to ensure that investment in ICTs leads to educational outcomes? This tries to understand how ICT can contribute to greater access to learning; to higher quality teaching; and to improved and more equitable learning outcomes.
2. What impact is ICT having upon the operation of educational institutions and upon educational policymaking? This tries to reflect on issues such as institutional frameworks for school management; the regulatory structures for educational institutions and teachers' work arrangements.

The need for linking ICT to education policies requires recognition. In reflecting the importance of technologies, education policies should focus in the following major points (UNDP, 2004):

(1) Education policies have to reflect alternate and new teaching paradigms that ICT can offer in terms of providing a more effective, relevant, and flexible mode of learning for the underprivileged and the general masses.

(2) Policies must take into account the retraining of teachers incorporating use of ICTs in education. Teachers should skilfully redesign learning environments so that students can transfer their newly gained ICT skills to other applications to use in an ICT rich environment.

(3) Most educational policies reflect the need for ICT infrastructure but they left out the need for local educational content. The

investments in hardware and resulting in a heavy economic and educational loss.

(4) The focus of developing countries should be on how they use ICTs to compensate for the factors that are lacking in education, namely, well-trained teachers and the resources to pay for expensive equipment. The task is to concentrate on technological alternatives that, at low cost, bring to students the imagination and creativity of a few excellent teachers.

**Promises of ICTs Use in Developing Countries** ( Reviewed from Kozma (2005) and Hare (2007))

**The World Links program**

The World Links program is a good initiation in the form of a project, originally managed by the World Bank to place internet-connected computers in secondary schools and train teachers in Africa, Latin America, the Middle East, and South and Southeast Asia. The goal of the program is to improve educational outcomes, economic opportunities, and global understanding for youth using information technology and new approaches to learning. Services provided by the program include:

- Feasibility studies and consultation on connectivity solutions and telecenter management,
- Internet connectivity for secondary schools in developing countries,
- School-to-school partnerships, as well as regional and global partnerships with public, private, and non-governmental organizations,
- Teacher professional development on issues of technology in the context of innovative pedagogy, and

- Workshops for policy makers on coordination of policies and implementation strategies

With the help of the World Links program, many countries are now using ICTs as

ways of providing teachers with new skills and introducing innovative pedagogies in the classroom. For example, teachers in Chile acquired familiarity with computers for professional (eg. student marks, parent reports) and out-of-classroom tasks (e.g. searching for educational content on the web and lesson-planning activities). The program also provides 200 hours of teacher training that include an introduction to ICT, use of the internet for teaching and learning, use of tele-collaborative learning projects, integration of ICTs into the curriculum and teaching, and innovative pedagogical approaches. Because of this, majority of teachers and school principals report that teachers trained with computer and teaching skills gained positive attitudes about technology and about teaching. Moreover, some Asian countries such as India, Thailand, and Indonesia realized the importance of ICT integration to their education policies. They are also investing in ICT infrastructure for schools and creating network links of education institutions.

On the other hand, developed countries are now making online education, smart schools, and virtual universities more of a norm. Developing countries are also fast catching. For instance, the Government of India, announced an ambitious program titled 'Vidya vahini' that is to create computer laboratories with facilities like internet access, an online library, academic services and web-casting across 60 thousand schools in the country in 2003. Vietnam has also invested to develop a computer based information network system for education called Education Network (EdNet) and improve computer

facilities at educational institutions. EdNet is the country's first step towards developing a computer based information network system for education. Thailand also

launched School Net, which has connected 4758 schools throughout the country. School Net Thailand is using the internet to improve the overall standard of education in the country by reducing the gap in quality of education between schools in urban and rural areas. Pakistan invested 5.18 million US dollar to provide connectivity across universities, secondary and primary schools in 2003.

ICTs make curriculum implementation learner-centred with a self-learning environment that enables the student customize his/her own learning experiences. In this respect, Malaysia initiated the concept of smart school, a learning institution with objectives to foster self-assessed, self-paced, and self-directed learning through the application of ICTs. The Sri Lankan Government also runs several key initiatives connecting 92 education centres across provinces, regions and sectors to the ministry, and developing computer-training centres at 8 hundred selected schools. In Namibia, integrating ICT into education and training systems, issues of access to the local and global knowledge and information found to be important. For this, the education and training sector created the ICT policy for education to enhance the use and development of ICT for education and training. Hence the five distinct development areas for the use of ICT mentioned in the policy are: (1) investigation and development of appropriate ICT solutions, (2) deployment of ICT, (3) maintenance and support of ICT, (4) ICT literacy, and (5) ICT integration.

The policy document also describes the provision and advantages of ICT as follows:

ICT provides a great deal of advantage in the delivery of equitable quality

education thereby providing an opportunity to improve the lives of our people. The need to use new technologies to raise the quality and efficiency of education cannot be overemphasized. It is imperative that we expose our children, parents, and teachers to ICT to improve the quality of education and technical proficiency of our human resources, thus leading to increased productivity and accelerated development. We must also prepare our citizens to adapt to the global economy and participate in electronic commerce. In addition, we must provide our children with a greater understanding of other peoples and cultures, thus defending our renewed legacy of peace and tolerance.

Moreover, few of ICTs benefits to the classroom and the education process mentioned in the document are that ICTs:-

- Offer the opportunity for more student-centred teaching,
- Provide greater opportunity for teacher-to-teacher and student-to-student communication and collaboration,
- Give greater exposure to vocational and workforce skills for students,
- Provide opportunities for multiple technologies delivered by teachers,
- Create greater enthusiasm for learning amongst students,
  
- Provide teachers with new sources of information and knowledge,
- Prepare learners for the real world,
- Provide distance learners country-wide with online educational materials

- Provide learners with additional resources to assist resource-based learning.

Furthermore, the document states ICTs to cover all the technologies used for holding and communicating information and their use specifically

in education with overall policy goals of:

- Producing ICT literate citizens,
- Producing people capable of working and participating in the new economies and societies arising from ICTs and related developments,
- Leveraging ICT to assist and facilitate learning for the benefit of all learners and teachers across the curriculum,
- Improving the efficiency of educational administration and management at every level from the classroom, school library, through the school and on to the sector as a whole,
- Broadening access to quality educational services for learners at all levels of the education system, and
- Set specific criteria and targets to help classify and categorize the different development levels of using ICT in education.

Tanzania introduced the use of computers in business and the need to train people to operate them. In response to this, Higher Education Institutes introduced courses in computer science and information technology. Several private training institutions were also established to train computer literacy. In addition, the Tanzanian Government planned and started the supply of computers to secondary schools. By the year 1997 the Ministry of Education and Culture has issued a syllabus for computer studies in secondary schools.

### **The WoredaNet and SchoolNet in Ethiopia**

In the case of Ethiopia's education system, ICT use, particularly the computer and

internet is very much limited though there is a clear policy direction. Awareness creation and preparation to use computer and the internet for learning seems promising. The promise founded itself on the launching of WoredaNet, an e-government communication and the ICT

strategy, which are the major enablers for the fast development of ICT use in the country (Hare, 2007). The public sector and the education sector have begun to benefit from Woredanet and the ICT strategy though the accomplishment is not to the perceived standard. The national e-education initiative with implementation strategy of ICT use in education and the subsequent action plans, for example, has come up because of the WoredaNet program.

The implementation strategy of the country, also called ICT for development plan number 6 has three broad categories as described by (Hare, 2007). These are (1) the Ethiopian National School Net initiative that is aimed at networking 500 schools and the utilization of ICTs to facilitate the teaching-learning process at primary, secondary, technical and vocational schools, (2) the National ICTs in Higher Education Initiative that focuses on orchestrating ICTs within universities, colleges, and research institutes to facilitate student learning, research activities, and community services, and (3) the national ICT Education, Training and Awareness Initiative that promotes ICT awareness and literacy, adult education and lifelong learning, and virtual distance learning in the country.

Furthermore, the implementation strategy recognizes ICT as a potential for widening access to education and facilitation for education delivery and training at all levels. Nevertheless, despite the efforts and the strategies in place, there are challenges to

coordinate the implementation of the initiatives. For instance, if we consider the second initiative, very few courses from institutes of technologies in universities are in the Moodle (modular object-oriented dynamic learning environments) platform

that employs the computer and internet connections to enrich student learning via blended design.

The most challenging condition to implement ICT strategy in Ethiopian schools is inadequacy of existing infrastructures. Even though integrating ICT use in the teaching-learning process was given due recognition in the implementation strategy, only about 40 percent of schools in the country have computers, and most of which are in Addis Ababa, causing a rural-urban divide to equity and access for quality education. Moreover, those schools, which have computers, experience limited or low access to internet connections.

On the other hand, lecturers in higher learning institutes are expected to adopt computers and the internet as a teaching tool. However, computers, network infrastructures and connections are not compatible to the size of enrolled students and existing demands. In addition, teachers do lack the required skill to match the technology (e.g. Computers and the internet) with innovative pedagogies that benefit students' learning. 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 (Carnoy, 2004). There is still little attempt, that is why the number of students in higher learning institutes using computers and the internet is insignificant. Students' skill of using the technology is also a series challenge that needs the attention of the

institutes. Thus, these have implications for the future, to work hard for the benefit of student learning from the use of technologies.

### **Limitations of ICT use in Education**

ICT as a modern technology that simplifies and facilitates human activities is not only advantageous in many respects, but also has many limitations. Many people from inside and outside the education system, think of ICT as “Panacea” or the most important solution to school problems and improvements. However, many conditions can be considered as limitations of ICT use in education. The limitations can be categorized as teacher related, student related, and technology related. All of them potentially limit the benefits of ICT to education.

Teachers’ attitude plays an important role in the teaching-learning process that utilizes computers and internet connections. Although teachers’ attitude towards use of these technologies is vital, many observations reveal that teachers do not have clarity about how far technology can be beneficial for the facilitation and enhancement of learning. Of course, some teachers may have positive attitudes to the technology, but refrain from using it in teaching due to low self-efficacy, tendency to consider themselves not qualified to teach with technology. In this respect, Bandura (1986) describes self-efficacy as “individual’s opinion of capabilities to organize and perform courses of actions to achieve particular types of performances.” Moreover, as identified by Brosnan (2001), attitude, motivation, computer anxiety, and computer self-efficacy are factors affecting teachers’ use of computers in their lessons. Teacher resistance and lack of enthusiasm

to use ICT in education may also be another limitation.

Furthermore, many teachers may not have the required IT skills and feel uncomfortable, nor do they have trainings needed to use the technology in their

teaching. Unless teachers develop some basic skills and willingness to experiment with students, ICT use in education is in a disadvantage (Brosnan, 2001).

On the other hand, the limitation of ICT use in education is related to student behaviour. Appropriate use of computer and the internet by students have significant positive effects on students’ attitude and their achievement. Nonetheless, it is very common to observe limitations related to student behaviour. Students tend to misuse the technology for leisure time activities and have less time to learn and study. Yousef and Dahmani (2008) described online gaming, use of face book, chat rooms, and other communication channels as perceived drawbacks of ICT use in education, because, students easily switch to these sites at the expense of their study. Internet access at home, for instance, may be a distraction because of chat rooms and online games, reducing the time spent in doing assignments and learning (Kulik, 1994). Therefore, the impact of availability of ICT on student learning strongly depends on its specific uses.

If ICT is not properly used, the disadvantage will overweight the advantage. For example, while students use the internet, it may confuse them by the multiplicity of information to choose from. As a result, the teacher spends much time to control students from websites unrelated to the learning content. Then, for caution, it is important to identify the major limitations of ICT use in education as related to student behaviour. The various literature in the area, identify the following

limitations of ICT use in education as related to student behaviour.

- Computers limit students' imaginations,
- Over-reliance on ICT limits students critical thinking and analytical skills,
- Students often have only a superficial understanding of the information they download,
- Computer-based learning has negative physical side-effects such as vision problem,
- Students may be easily distracted from their learning and may visit unwanted sites,
- Students tend to neglect learning resources other than the computer and internet,
- Students tend to focus on superficial presentations and copying from the internet,
- Students may have less opportunity to use oral skills and hand writing,
- Use of ICT may be difficult for weaker students, because they may have problems with working independently and may need more support from the teacher.

The other limitation of ICT use in education is technology related. The high cost of the technology and maintenance of the facilities, high cost of spare parts, virus attack of software and the computer, interruptions of internet connections, and poor supply of electric power are among the technology related limitations of ICT use in education.

**The Key Challenges of ICTs Integration in Education**

The integration of ICTs in education systems may face various challenges with respect to policy, planning, infrastructure, learning content and language, capacity building and financing. ICT-enhanced

education requires clearly stated objectives, mobilization of resources and political commitment of the concerned bodies. Tinio (2002) discusses issues such as analysis of current practices and arrangements,

identification of potential drives and barriers, curriculum and pedagogy, infrastructure and capacity building to be considered in the formulation of policy and planning. In addition, it is wise to specify educational goals at different education and training levels as well as the different modalities of ICT use that can facilitate in the pursuit of the goals. Policy makers then, need to know the potentials of ICTs in applying different contexts for different purposes. Other challenging points at the level of policy and planning are identification of stakeholders and harmonization of efforts across different interest groups, the piloting of the chosen ICT-based model, and specification of existing sources of financing and the development of strategies for generating financial resources to support ICT use over the long term.

The infrastructure challenges that may exist are absence of appropriate buildings and rooms to house the technology, shortage of electric supply and telephone lines, and lack of the different types of ICTs. Because of this, one need to deal with infrastructure related challenges before the planning of ICTs integration to education systems.

With respect to challenges of capacity building, we have to develop competencies of teachers and school administrators for the successful integration of ICT in the education system. In fact, one impeding factor of ICTs integration in education systems is the skill gap of people implementing it (Tinio, 2002). For instance, teachers need professional development to gain skills with particular applications of ICT, integration into

existing curricula, curricular changes related to its use, changes in teacher role, and on underpinning educational theories such as constructivism/or student-centred learning. Because of this, any attempt of

ICT integration in education should parallel with teachers professional development. The school leadership also plays a key role in the integration of ICT in education. Lack of support from the school administration is also a big challenge. Thus, for the effectiveness of ICT integration, administrators must be competent and have a broad understanding of the technical, curricular, administrative, financial, and social dimensions of ICT use in education.

Furthermore, learning content and language also challenge the integration of ICT in education. Content development is a critical area that educators overlook. In integrating ICT in education, we have to care for the relevance of the learning content to the target groups. With respect to language, English is the dominant language in many of educational software, while English language proficiency is not high in many of the developing countries, and this is one barrier in the integration of ICT to education. Another great challenge is the financing. ICTs in education programs require large capital investment and developing countries need to predict the benefit of ICT use to balance the cost relative to the existing alternatives. Potential sources of money and resources for ICT use programs suggested are grants, public subsidies, fund-raising events, in kind support from volunteers, community support, revenues earned from core business, and revenues earned from ancillary activities (Tinio, 2002). Overcoming the mentioned challenges may help education systems benefit the most from this technology.

### **Summary and the Way Forward**

This review article attempts to answer questions on the roles of ICTs in education, existing promises, limitations and the challenges of its integration in education systems. Information communication

technologies are influencing all aspects of life including education. They are promoting changes in working conditions, handling and exchanging of information, teaching-learning approaches and so on. One area in which the impacts of ICT is significant, is education. ICTs are making major differences in the teaching approaches and the ways students are learning. ICT-enhanced learning environment facilitates active, collaborative, creative, integrative, and evaluative learning as an advantage over the traditional method. In other words, ICT is becoming more appropriate in the realization and implementation of the emerging pedagogy of constructivism that gives greater responsibility of learning for students. Several surveys are showing that ICT use in education systems of developed nations has comparatively advanced than ICT use in education systems of developing nations. In addition, the major promises of ICTs use in education systems of developing countries focus on training teachers in new skills and introducing innovative pedagogies into the classrooms, investing on ICT infrastructure for schools and creating networks among educational institutes, improving overall standard of education by reducing the gap in quality of education between schools in urban and rural areas, initiation of smart school with objectives to foster self-paced, self-assessed, and self-directed learning through the applications of ICTs, and developing ICT policy for education and training. On the other hand, this article discusses the major limitations of ICT use in education as teacher related, student related, and technology related. In addition, the key challenges of ICTs integration into

education systems discussed relate to policy, planning, infrastructure, learning content and language, capacity building and financing.

Carnoy, M. (2002). ICT in Education: Possibilities and Challenges. (Downloaded from: <http://www.uoc.edu>, 04 March 2011).

What will be the way forward then? There is a consensus that the development of any country depends upon the quality of education programs offered to citizens. ICTs, despite their known limitations, are believed to be beneficial in this regard. The computer and the internet are especially useful to enhance student engagement in learning and positively impact student performance and achievement. Moreover, their usefulness is more apparent in the 21<sup>st</sup> century, where the time is an era of information rich that the conventional modes of teaching learning could hardly handle it. The reviewer of this article strongly recommends the mainstreaming of ICT utilization (particularly the computer and internet) in education systems at levels, for they benefit curriculum implementation and enhanced student learning. Therefore, education policy makers, educators and all concerned should evaluate and recognize the roles of ICT in education in order to work for the effective functioning of this technology in their education systems.

Hare, H. (2007). Survey of ICT and Education in Africa: Ethiopia Country Report (ICT in Education in Ethiopia). [www.infodev.org](http://www.infodev.org) downloaded February 28

Jonassen, D.H. (1991). Objectivism versus constructivism: Do we need a new philosophical paradigm?  
*Educational Technology Research and development*, 39(3), 5-14

Kok, A. (2007). *ICT Integration into Classrooms*: Unpublished literature review

Kozma, R.B. (2005). National policies that connect ICT-based education reform to economic and social development. *An interdisciplinary journal of humans in ICT environment* 1(2) 117-156

Kulik, J.A. (1994). Meta-analytic studies of findings on computer-based instruction. In J.E.L.Baker & H.F.O'Neil (Ed.), *Technology Assessment in Education and Training*. Hillsdale, NJ: Lawrence Erlbaum

OECD. (2002). ICT: Policy Challenges for Education. Planning Meeting, Agenda and Issue Paper.  
(Retrieved from <https://www.oecd.org/LongAbstract> on December 2009)

Olson, J. (2000). Trojan horse or Teacher's Pet? Computer and the Culture of the School.  
*Journal of Curriculum Studies*, 32 (1), 1-8.

## REFERENCES

Bandura, A. (1986). *Social foundations of thought and action: A Social-Cognitive View*. Englewood cliffs, NJ: Prentice-Hall

Brosnan, T. (2001). *Teaching Using ICT*. University of London: Institute of Education.

Pedro et.al. (2004). Technology in Schools: Education, ICT and the Knowledge Society.

(Retrieved from [http://www.worldbank.org/education/pdf/ict\\_report\\_oct04.pdf](http://www.worldbank.org/education/pdf/ict_report_oct04.pdf) on December 2009)

Tinio, V.L. (2002). ICT in Education: UN Development Programme.

(Retrieved from <http://www.eprmers.org> on December 2009)

UNDP. (2004). Promoting ICT for Human Development. A Pioneering Regional Human Development

Report in Asia in 2004: Realizing the Millennium Development Goals (Retrieved from

<http://www.apdip.net/projects/rhdr/resources/PDF> on December 2009)

Volman M. (2005). Variety of roles for a new type of teacher. Educational technology and the teacher profession. *Teacher and Teacher Education*, 21, 15-31.

Voogt, J. (2003). Consequences of ICT for aims, contents, processes, and environments of learning. In J. van den Akker, W. Kuiper & U. Hameyer (Eds.), *Curriculum landscapes and trends* (pp 217 – 236). Dordrecht: Kluwer Academic Publishers.

Watson, D.M. (2001). Pedagogy before Technology: Re-thinking the Relationship between ICT and Teaching. *Education and Information Technologies*, 6, 4, 251-266.

Yousef, A. B. and Dahamini, M. (2008). The Economics of E- Learning: The Impact of ICT on Student Performance in Higher Education: Direct Effects, Indirect Effects and Organizational Change (<http://rusc.uoc.edu>, downloaded March 4, 2011)