

An Effective use of ICT for Education and Learning by Drawing on Worldwide Knowledge, Research, and Experience:

ICT as a Change Agent for Education

(A LITERATURE REVIEW)

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The purpose of this paper aims to bring together the findings and key points from a review of significant part of the available literature associated with ICTs for Education and ICTs in Education. This review set out to identify and evaluate relevant strategies in national and international research and initiatives related to measuring and demonstrating the effective use of ICT for education with regard to the teaching learning process; ICT and quality and accessibility of education; ICT and learning motivation, ICT and learning environment, and ICT to enhance the scholastic performance.

Abstract:

Information and communication technologies (ICT) have become commonplace entities in all aspects of life. Across the past twenty years the use of ICT has fundamentally changed the practices and procedures of nearly all forms of endeavour within business and governance. Education is a very socially oriented activity and quality education has traditionally been associated with strong teachers having high degrees of personal contact with learners. The use of ICT in education lends itself to more student-centred learning settings. But with the world moving rapidly into digital media and information, the role of ICT in education is becoming more and more important and this importance will continue to grow and develop in the 21st century. In this paper, a literature review regarding the use of ICTs in education was provided. Effective use of ICT for Education, along with ICT use in the teaching learning process; quality and accessibility of education; learning motivation. Learning environment. Besides, an overview of the ICT and scholastic performance.

Introduction

According to Daniels (2002) ICTs have become within a very short time, one of the basic building blocks of modern society. Many countries now regard understanding ICT and mastering the basic skills and concepts of ICT as part of the core of education, alongside reading, writing and numeracy. However, there appears to be a misconception that ICTs generally refers to ‘computers and computing related activities’. This is fortunately not the case, although computers and their application play a significant role in modern information management, other technologies and/or systems also comprise of the phenomenon that is commonly regarded as ICTs. Pelgrum and Law (2003) state that near the end of the 1980s, the term ‘computers’ was replaced by ‘IT’ (information technology) signifying a shift of focus from computing technology to the capacity to store and retrieve information. This was followed by the introduction of the term ‘ICT’ (information and communication technology) around 1992, when e-mail started to become available to the general public (Pelgrum, W.J., Law, N., 2003). According to a United Nations report (1999) ICTs cover Internet service provision, telecommunications equipment and services, information technology equipment and services, media and broadcasting, libraries and documentation centres, commercial information providers, network-based information services,

and other related information and communication activities. According to UNESCO (2002) information and communication technology (ICT) may be regarded as the combination of 'Informatics technology' with other related technology, specifically communication technology. The various kinds of ICT products available and having relevance to education, such as teleconferencing, email, audio conferencing, television lessons, radio broadcasts, interactive radio counselling, interactive voice response system, audiocassettes and CD ROMs etc have been used in education for different purposes (Sharma, 2003; Sanyal, 2001; Bhattacharya and Sharma, 2007)..

The field of education has been affected by ICTs, which have undoubtedly affected teaching, learning, and research (Yusuf, 2005). A great deal of research has proven the benefits to the quality of education (Al-Ansari, 2006). ICTs have the potential to innovate, accelerate, enrich, and deepen skills, to motivate and engage students, to help relate school experience to work practices, create economic viability for tomorrow's workers, as well as strengthening teaching and helping schools change (Davis and Tearle, 1999; Lemke and Coughlin, 1998; cited by Yusuf, 2005). As Jhuree (2005) states, much has been said and reported about the impact of technology, especially computers, in education. Initially computers were used to teach computer programming but the development of the microprocessor in the early 1970s saw the introduction of affordable microcomputers into schools at a rapid rate. Computers and applications of technology became more pervasive in society which led to a concern about the need for computing skills in everyday life. Hepp, Hinostraza, Laval and Rehbein (2004) claim in their paper "Technology in Schools: Education, ICT and the Knowledge Society" that ICTs have been utilized in education ever since their inception, but they have not always been massively present. Although at that time computers have not been fully integrated in the learning of traditional subject matter, the commonly accepted rhetoric that education systems would need to prepare citizens for lifelong learning in an information society boosted interest in ICTs (Pelgrum, W.J., Law, N., 2003).

The 1990s was the decade of computer communications and information access, particularly with the popularity and accessibility of internet-based services such as electronic mail and the World Wide Web (WWW). At the same time the CD-ROM became the standard for distributing packaged software (replacing the floppy disk). As a result educators became more focused on the use of the technology to improve student learning as a rationale for investment. Any discussion about the use of computer systems in schools is built upon an understanding of the link between schools, learning and computer technology. When the potential use of computers in schools was first mooted, the predominant conception was that students would be 'taught' by computers (Mevarech & Light, 1992). In a sense it was considered that the computer would 'take over' the teacher's job in much the same way as a robot computer may take over a welder's job. Collis (1989) refers to this as "a rather grim image" where "a small child sits alone with a computer". However, the use of information and communication technologies in the educative process has been divided into two broad categories: ICTs for Education and ICTs in Education. ICTs for education refers to the development of information and communications technology specifically for teaching/learning purposes, while the ICTs in education involves the adoption of general components of information and communication technologies in the teaching learning process.

ICT enhancing teaching and learning process

The field of education has been affected by ICTs, which have undoubtedly affected teaching, learning and research (Yusuf, 2005). ICTs have the potential to accelerate, enrich, and deepen skills, to motivate and engage students, to help relate school experience to work practices, create economic viability for tomorrow's workers, as well as strengthening teaching and helping schools change (Davis and Tearle, 1999; Lemke and Coughlin, 1998; cited by Yusuf, 2005). In a rapidly changing world, basic education is essential for an individual be able to access and apply information. Such ability must find include ICTs in the global village.

Conventional teaching has emphasized content. For many years course have been written around textbooks. Teachers have taught through lectures and presentations interspersed with tutorials and learning activities designed to consolidate and rehearse the content. Contemporary settings are now favouring curricula that promote competency and performance. Curricula are starting to emphasize capabilities and to be concerned more with how the information will be used than with what the information is. Contemporary ICTs are able to provide strong support for all these requirements and there are now many outstanding examples of world class settings for competency and performance-based curricula that make sound use of the affordances of these technologies (Oliver, 2000). The integration of information and communication technologies can help revitalize teachers and students. This can help to improve and develop the quality of education by providing curricular support in difficult subject areas. To achieve these objectives, teachers need to be involved in collaborative projects and development of intervention change strategies, which would include teaching partnerships with ICT as a tool. According to Zhao and Cziko (2001) three conditions are necessary for teachers to introduce ICT into their classrooms: teachers should believe in the effectiveness of technology, teachers should believe that the use of technology will not cause any disturbances, and finally teachers should believe that they have control over technology. However, research studies show that most teachers do not make use of the potential of ICT to contribute to the quality of learning environments, although they value this potential quite significantly (Smeets, 2005). Harris (2002) conducted case studies in three primary and three secondary schools, which focused on innovative pedagogical practices involving ICT. Harris (2002) concludes that the benefits of ICT will be gained "...when confident teachers are willing to explore new opportunities for changing their classroom practices by using ICT. As a consequence, the use of ICT will not only enhance learning environments but also prepare next generation for future lives and careers (Wheeler, 2001). Changed pool of teachers will come changed responsibilities and skill sets for future teaching involving high levels of ICT and the need for more facilitative than didactic teaching roles (Littlejohn et al., 2002).

According to Cabero (2001), "the flexibilization time-space accounted for by the integration of ICT into teaching and learning processes contributes to increase the interaction and reception of information. Such possibilities suggest changes in the communication models and the teaching and learning methods used by teachers, giving way to new scenarios which favour both individual and collaborative learning". The use of ICT in educational settings, by itself acts as a catalyst for change in this domain. ICTs by their very nature are tools that encourage and support independent learning. Students using ICTs for learning purposes become immersed in the process of learning and as more and more students use computers as information sources and cognitive tools (Reeves & Jonassen, 1996), the influence of the technology on supporting how students learn will continue to increase. In the past, the conventional process of teaching has revolved around teachers planning and leading students through a series of

instructional sequences to achieve a desired learning outcome. Typically these forms of teaching have revolved around the planned transmission of a body of knowledge followed by some forms of interaction with the content as a means to consolidate the knowledge acquisition. Contemporary learning theory is based on the notion that learning is an active process of constructing knowledge rather than acquiring knowledge and that instruction is the process by which this knowledge construction is supported rather than a process of knowledge transmission (Duffy & Cunningham, 1996). In this domain learning is viewed as the construction of meaning rather than as the memorisation of facts (Lebow, 1993; Jonassen & Reeves, 1996). Learning approaches using contemporary ICTs provide many opportunities for constructivist learning through their provision and support for resource-based, student centered settings and by enabling learning to be related to context and to practice (Berge, 1998; Barron, 1998). As mentioned previously, any use of ICT in learning settings can act to support various aspects of knowledge construction and as more and more students employ ICTs in their learning processes, the more pronounced the impact of this will become. Teachers generate meaningful and engaging learning experiences for their students, strategically using ICT to enhance learning. Students enjoy learning, and the independent enquiry which innovative and appropriate use of ICT can foster. They begin to acquire the important 21st century skills which they will need in their future lives.

ICT enhancing the quality and accessibility of education

ICT increases the flexibility of delivery of education so that learners can access knowledge anytime and from anywhere. It can influence the way students are taught and how they learn as now the processes are learner driven and not by teachers. This in turn would better prepare the learners for lifelong learning as well as to improve the quality of learning. In concert with geographical flexibility, technology-facilitated educational programs also remove many of the temporal constraints that face learners with special needs (Moore & Kearsley, 1996). Students are starting to appreciate the capability to undertake education anywhere, anytime and anyplace.

One of the most vital contributions of ICT in the field of education is- Easy Access to Learning. With the help of ICT, students can now browse through e-books, sample examination papers, previous year papers etc. and can also have an easy access to resource persons, mentors, experts, researchers, professionals, and peers-all over the world. This flexibility has heightened the availability of just-in-time learning and provided learning opportunities for many more learners who previously were constrained by other commitments (Young, 2002). Wider availability of best practices and best course material in education, which can be shared by means of ICT, can foster better teaching. ICT also allows the academic institutions to reach disadvantaged groups and new international educational markets. As well as learning at anytime, teachers are also finding the capabilities of teaching at any time to be opportunistic and able to be used to advantage. Mobile technologies and seamless communications technologies support 24x7 teaching and learning. Choosing how much time will be used within the 24x7 envelope and what periods of time are challenges that will face the educators of the future (Young, 2002). Thus, ICT enabled education will ultimately lead to the democratization of education. Especially in developing countries like India, effective use of ICT for the purpose of education has the potential to bridge the digital divide.

India has a billion-plus population and a high proportion of the young and hence it has a large formal education system. The demand for education in developing countries like India has skyrocketed as education is still regarded as an important bridge of social, economic and political mobility (Amutabi and Oketch, 2003). There exist infrastructure, socio- economic, linguistic and

physical barriers in India for people who wish to access education (Bhattacharya and Sharma, 2007). This includes infrastructure, teacher and the processes quality. There exist drawbacks in general education in India as well as all over the world like lack of learning materials, teachers, remoteness of education facilities, high dropout rate etc (UNESCO,2002). Innovative use of Information and Communication Technology can potentially solve this problem. Internet usage in home and work place has grown exponentially (McGorry, 2002). ICT has the potential to remove the barriers that are causing the problems of low rate of education in any country. It can be used as a tool to overcome the issues of cost, less number of teachers, and poor quality of education as well as to overcome time and distance barriers (McGorry, 2002).

People have to access knowledge via ICT to keep pace with the latest developments (Plomp, Pelgrum & Law, 2007). ICT can be used to remove communication barriers such as that of space and time (Lim and Chai, 2004). ICTs also allow for the creation of digital resources like digital libraries where the students, teachers and professionals can access research material and course material from any place at any time (Bhattacharya and Sharma, 2007; Cholin, 2005). Such facilities allow the networking of academics and researchers and hence sharing of scholarly material. This avoids duplication of work (Cholin, 2005).ICT eliminating time barriers in education for learners as well as teacher. It eliminates geographical barriers as learners can log on from any place (Sanyal, 2001; Mooij, 2007; Cross and Adam, 2007; UNESCO, 2002; Bhattacharya and Sharma, 2007). ICT provides new educational approaches (Sanyal, 2001). It can provide speedy dissemination of education to target disadvantaged groups (UNESCO, 2002; Chandra and Patkar, 2007).ICT enhances the international dimension of educational services (UNESCO, 2002). It can also be used for non-formal education like health campaigns and literacy campaigns (UNESCO, 2002). Use of ICT in education develops higher order skills such as collaborating across time and place and solving complex real world problems (Bottino, 2003; Bhattacharya and Sharma, 2007; Mason, 2000; Lim and Hang, 2003). It improves the perception and understanding of the world of the student. Thus, ICT can be used to prepare the workforce for the information society and the new global economy (Kozma, 2005). Plomp et al (2007) state that the experience of many teachers, who are early innovators, is that the use of ICT is motivating for the students as well as for the teachers themselves. Bottino (2003) and Sharma (2003) mention that the use of ICT can improve performance, teaching, administration, and develop relevant skills in the disadvantaged communities. It also improves the quality of education by facilitating learning by doing, real time conversation, delayed time conversation, directed instruction, self-learning, problem solving, information seeking and analysis, and critical thinking, as well as the ability to communicate, collaborate and learn (Yuen et al, 2003). A great deal of research has proven the benefits to the quality of education (Al-Ansari 2006).Hepp,Hinostroza, Laval and Rehbein (2004) state that the literature contains many unsubstantiated claims about the revolutionary potential of ICTs to improve the quality of education. They also note that some claims are now deferred to a near future when hardware will be presumably more affordable and software will become, at last, an effective learning tool.

ICT enhancing learning Environment

ICT presents an entirely new learning environment for students, thus requiring a different skill set to be successful. Critical thinking, research, and evaluation skills are growing in importance as students have increasing volumes of information from a variety of sources to sort through (New Media Consortium, 2007).ICT is changing processes of teaching and learning by adding elements of vitality to learning environments including virtual environments for the

purpose. ICT is a potentially powerful tool for offering educational opportunities. It is difficult and maybe even impossible to imagine future learning environments that are not supported, in one way or another, by Information and Communication Technologies (ICT).

When looking at the current widespread diffusion and use of ICT in modern societies, especially by the young the so-called digital generation then it should be clear that ICT will affect the complete learning process today and in the future. Authenticity is an important issue which should be addressed in the design and development of learning environments (Collins, 1996). Learning environments need to reflect the potential uses of knowledge that pupils are expected to master, in order to prevent the acquired knowledge from becoming inert (Bransford, Sherwood, Hasselbring, Kinzer, & Williams, 1990; Duffy & Knuth, 1990). In addition, teachers should stimulate pupils to engage in active knowledge construction. This calls for open-ended learning environments instead of learning environments which focus on a mere transmission of facts (Collins, 1996; Hannafin, Hall, Land, & Hill, 1994; Jonassen, Peck, & Wilson, 1999). ICT may contribute to creating powerful learning environments in numerous ways.

ICT provides opportunities to access an abundance of information using multiple information resources and viewing information from multiple perspectives, thus fostering the authenticity of learning environments. ICT may also make complex processes easier to understand through simulations that, again, contribute to authentic learning environments. Thus, ICT may function as a facilitator of active learning and higher-order thinking (Alexander, 1999; Jonassen, 1999). The use of ICT may foster co-operative learning and reflection about the content (Susman, 1998). Furthermore, ICT may serve as a tool to curriculum differentiation, providing opportunities for adapting the learning content and tasks to the needs and capabilities of each individual pupil and by providing tailored feedback (Mooij, 1999; Smeets & Mooij, 2001). As Stoddart and Niederhauser (1993) point out, ICT may fit into a spectrum of instructional approaches, varying from traditional to innovative. Another aspect which may of course influence the use of ICT is access to technology (Kennewell, Parkinson, & Tanner, 2000; OTA, 1995). This refers not only to the number of computers, but also to the placement of the equipment, e.g. in the classroom or in a computer room. Kennewell et al. (2000) feel it is essential that computers be placed in the classroom, in order to maximize the opportunities for curriculum activity. ICT environment improves the experience of the students and teachers and to use intensively the learning time for better results. The ICT environment has been developed by using different software and also the extended experience in developing web based and multimedia materials. ICTs have an important role to play in changing and modernizing educational systems and ways of learning.

ICT enhancing learning motivation

ICTs can enhance the quality of education in several ways, by increasing learner motivation and engagement, by facilitating the acquisition of basic skills, and by enhancing teacher training. ICTs are also transformational tools which, when used appropriately, can promote the shift to a learner centered environment. ICTs, especially computers and Internet technologies, enable new ways of teaching and learning rather than simply allow teachers and students to do what they have done before in a better way. ICT has an impact not only on what students should learn, but it also plays a major role on how the students should learn. Along with a shift of curricula from “content-centered” to “competence-based”, the mode of curricula delivery has now shifted from “teacher centered” forms of delivery to “student-centered” forms of delivery. ICT provides Motivation to Learn. ICTs such as videos, television and multimedia computer software that

combine text, sound, and colourful moving images can be used to provide challenging and authentic content that will engage the student in the learning process. Interactive radio likewise makes use of sound effects, songs, dramatizations, comic skits, and other performance conventions to compel the students to listen and become more involved in the lessons being delivered. Some of the parents of the respondents opined that their children were feeling more motivated than before in such type of teaching in the classroom rather than the stereotype 45 minutes lecture. They were of the view that this type of learning process is much more effective than the monotonous monologue classroom situation where the teacher just lectures from a raised platform and the students just listen to the teacher.

ICT changes the characteristics of problems and learning tasks, and hence play an important task as mediator of cognitive development, enhancing the acquisition of generic cognitive competencies as essential for life in our knowledge society. Students using ICTs for learning purposes become immersed in the process of learning and as more and more students use computers as information sources and cognitive tools (Reeves and Jonassen, 1996), the influence of the technology on supporting how students learn will continue to increase.

Learning approaches using contemporary ICTs provide many opportunities for constructivist learning through their provision and support for resource-based, student centered settings and by enabling learning to be related to context and to practice (Berge, 1998; Barron, 1998). The teachers could make their lecture more attractive and lively by using multi-media and on the other hand the students were able to capture the lessons taught to them easily. As they found the class very interesting, the teachings also retained in their mind for a longer span which supported them during the time of examination. More so than any other type of ICT, networked computers with Internet connectivity can increase learner motivation as it combines the media richness and interactivity of other ICTs with the opportunity to connect with real people and to participate in real world events. ICT-enhanced learning is student-directed and diagnostic. Unlike static, text- or print-based educational technologies, ICT-enhanced learning recognizes that there are many different learning pathways and many different articulations of knowledge. ICTs allow learners to explore and discover rather than merely listen and remember. The World Wide Web (WWW) also provides a virtual international gallery for students' work (Loveless, 2003). ICT can engage and inspire students, and this has been cited as a factor influencing ready adaptors of ICT (Long, 2001; Wood, 2004).

ICT enhancing the scholastic performance

Based on the extensive usage of ICTs in education the need appeared to unravel the myth that surrounds the use of information and communication technology (ICT) as an aid to teaching and learning, and the impact it has on students' academic performance. ICTs are said to help expand access to education, strengthen the relevance of education to the increasingly digital workplace, and raise educational quality. However, the experience of introducing different ICTs in the classroom and other educational settings all over the world over the past several decades suggests that the full realization of the potential educational benefits of ICT. The direct link between ICT use and students' academic performance has been the focus of extensive literature during the last two decades. ICT helps students to their learning by improving the communication between them and the instructors (Valasidou and Bousiou, 2005).

The analysis of the effects of the methodological and technological innovations on the students' attitude towards the learning process and on students' performance seems to be evolving towards a consensus, according to which an appropriate use of digital technologies in

education can have significant positive effects both on students' attitude and their achievement. Research has shown that the appropriate use of ICTs can catalyze the paradigmatic shift in both content and pedagogy that is at the heart of education reform in the 21st century. Kulik's (1994) meta-analysis study revealed that, on average, students who used ICT-based instruction scored higher than students without computers. The students also learned more in less time and liked their classes more when ICT-based instruction was included. Fuchs and Woessman (2004) used international data from the Programme for International Student Assessment (PISA), they showed that while the bivariate correlation between the availability of ICT and students' performance is strongly and significantly positive, the correlation becomes small and insignificant when other student environment characteristics are taken into consideration. Attwell and Battle (1999) examined the relationship between having a home computer and school performance, their findings suggest that students who have access to a computer at home for educational purposes, have improved scores in reading and math. Becker (2000) found that ICT increases student engagement, which leads to an increased amount of time students spend working outside class. Coates et al. (2004) showed that students in on-campus courses usually score better than their online counterparts, but this difference is not significant here. ICTs especially computers and Internet technologies enable new ways of teaching and learning rather than simply allow teachers and students to do what they have done before in a better way.

ICT helps in providing a catalyst for rethinking teaching practice (Flecknoe, 2002; McCormick & Scrimshaw, 2001) developing the kind of graduates and citizens required in an information society (Department of Education, 2001); improving educational outcomes (especially pass rates) and enhancing and improving the quality of teaching and learning (Wagner, 2001; Garrison & Anderson, 2003). ICT can help deepen students' content knowledge, engage them in constructing their own knowledge, and support the development of complex thinking skills (Kozma, 2005; Kulik, 2003; Webb & Cox, 2004). Studies have identified a variety of constructivist learning strategies (e.g., students work in collaborative groups or students create products that represent what they are learning) that can change the way students interact with the content (Windschitl, 2002). Albert Bandura, Girasoli and Hannafin (2008) urge the use of asynchronous CMC tools to promote student self-efficacy and hence academic performance. Fister et al (2008) also depict the power of tablet PCs to improve mathematics instruction. ICTs have the potential for increasing access to and improving the relevance and quality of education. The use of ICT in educational settings, by itself acts as a catalyst for change in this domain. Students using ICTs for learning purposes become immersed in the process of learning and as more and more students use computers as information sources and cognitive tools (Reeves and Jonassen, 1996), the influence of the technology on supporting how students learn will continue to increase.

General Conclusions of the review

In order to conclude we will try to proceed to synthesize from a general viewpoint the results obtained, taking into consideration the relevant aspects of the literature. The results provided by both the quantitative and qualitative analysis of the literature obtained will be exposed especially regarding those aspects which are related to ICTs for Education and ICTs in Education. ICTs for education refers to the development of information and communications technology specifically for teaching/learning purposes, while the ICTs in education involves the adoption of general components of information and communication technologies in the teaching learning process.

This literature review has sought to explore the role of ICT in education as we progress into the 21st century. In particular ICTs have impacted on educational practice in education to date in quite small ways but that the impact will grow considerably in years to come and that ICT will become a strong agent for change among many educational practices. Extrapolating current activities and practices, the continued use and development of ICTs within education will have a strong impact on: ICT and teaching learning process; quality and accessibility of education; learning motivation, learning environment and ICT usage and academic performance.

The adoption and use of ICTs in education have a positive impact on teaching, learning, and research. ICT can affect the delivery of education and enable wider access to the same. In addition, it will increase flexibility so that learners can access the education regardless of time and geographical barriers. It can influence the way students are taught and how they learn. It would provide the rich environment and motivation for teaching learning process which seems to have a profound impact on the process of learning in education by offering new possibilities for learners and teachers. These possibilities can have an impact on student performance and achievement. Similarly wider availability of best practices and best course material in education, which can be shared by means of ICT, can foster better teaching and improved academic achievement of students. The overall literature suggests that successful ICT integration in education.

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