# Impact of ICT in Teaching and Learning-A Review

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## Abstract

This paper attempts to review the role of ICT in education for the 21st century. In particular it has been argued that 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. It is observed that use of ICT in education is increasing very rapidly. This paper presents a meta analysis of the relevant literature that aims to present the impact of information and communication technology in teaching and learning. In order to improve the impact of ICT on learning, the paper concludes that a holistic approach is needed that takes into account the socio-economic context, the learning environment, and teacher training.
**Key words:** ICT, Education, Digital.

## Background:

It is difficult 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 in the future. Schools, Colleges and universities invest billions of dollars per year for the acquisition of computer technology. [Geoghegan,1994]. Instructional technology may support and increase the efficiency of the teaching-learning transaction or even modify educational processes, especially with regards to distance education and "anytime, anywhere" access [Daniel, 1997]. In some cases, integrating technology into the teaching-learning transaction has been found to transform the teacher's role from being the traditional "sage on the stage" to *also* being a "guide on the side", and student roles also change from being passive receivers of content to being more active participants and partners in the learning process.

Transfer of knowledge, which is one of the foundations of learning, is among the most fundamental social achievements of human beings. Building strong relationships with students is something that frequently explains why faculty takes pleasure in the challenge of working at a small place. The concept of moving the traditional classroom of desks, notebooks, pencils, and black board to an online forum of computers, software, and the Internet intimidates many teachers who are accustomed to the face-to-face interaction of the traditional classroom. However, in the past 10 years, online instruction has become extremely popular as is evident in the rise of online universities, such as University of Phoenix Online and Athabasca University (Canada), and on-campus universities offering online courses and degrees, such as Harvard University and University of Toronto. For many students who find it difficult to come to campus due to employment, family responsibilities, health issues, and other time constrains, online education is the only option. Computer multimedia offers ideal opportunities for creating and presenting visually enriched learning environments. The latest technologies associated with virtual reality will also play an important role in not too distance future. There is no doubt that technology-based tools can enhance student's cognitive performance and achievements if used appropriately, in accordance with knowledge learning and as part of a coherent educational approach. Nonetheless, it is worthwhile to study the impact of ICT on teaching and learning so as to know its shortcomings and enhance its use in teaching-learning environments.

## The objective of the study

This paper aims to bring together the findings and key points from a review of the significant part of the available literature associated with the impact of ICT into teaching and learning. Studying the impact of ICT on teaching and learning is crucial because this knowledge could provide guidance for the ways to enhance the use of ICT in the teaching –learning environments. Hence, there is a need to bring evidence together on the impact of ICT on teaching and learning. This is the objective of this paper. It contains a review of 20 studies and/or reports which provide evidence of the impact of ICT on learning (education and training).

**Methodology**

The paper is a descriptive account of the contemporary situation with regard to the impact of ICT on teaching and learning and draws on a variety of secondary sources both published and unpublished.

**Findings**

The findings of the review are given under the following headings:

**1.      The role of ICT in education**: Several studies argue that the use of new technology in the classroom is essential for providing opportunities for students to learn to operate in an information age. It is evident, as  Yelland (2001) argued, that traditional educational environments do not seem to be suitable for preparing learners to function or be productive in the workplaces of today's society. This argument is supported by Grimus (2000), who pointed out that "by teaching ICT skills in school, the pupils are prepared to face future developments based on proper understanding" (p.362). Similarly, Bransford et.al (2000) reported that "what is now known about learning provides important guidelines for uses of technology that can help teachers and students develop the competences needed for the twenty-first century" (p.206).

According to Bransford et.al (2000), several studies have reviewed the literature on ICT and learning and have concluded that it has great potential to enhance student achievement and teacher learning. Wong et.al (2006) point out that technology can play a part in supporting face-to-face teaching and learning in the

classroom. Many researchers and theorists assert that the use of computers help students to become knowledgeable, reduce the amount of direct instruction given to them and give teachers an opportunity to help those students with particular needs (Iding, Crosby, & Speitel, 2002; Shamatha, Peressini, &Meymaris 2004). According to Grabe and Grabe (2007), technologies play a role in improving student's skills, motivation and knowledge. They claim that ICT can be used to present information to students and help them complete learning tasks. According to Becta (p.10, 2003) five factors influence the likelihood that good ICT learning opportunities will develop in schools: ICT resourcing, ICT leadership, ICT teaching, school leadership and general teaching. Becta (2003) also indicated that the success of integration of new technology into education varies from curriculum to curriculum, place to place and class to class, depending on the ways in which it is applied.

**2. Science education and ICT:** In the past few decades Science curriculum has changed to match the new aims of science education and it will continue to change (Osborne and Henessey, 2003).They state that the latest move towards the "teaching about science rather than teaching its content will require a significant change in its mode of teaching and an improved knowledge and understanding in teachers"(p.4). They emphasize that along with the changes in views on the nature of science and the role of science education, the increase in the number of ICTs offers a challenge to science teaching and learning.

One of the potential benefits from the use of ICT in science learning is the encouragement of communication and collaboration in science research activities. According to Gillespie (2006), new technologies can be used in primary science education to enable students to collect science information and interact with resources, such as images and videos, and to encourage imagination and collaboration. Murphy (2006) reviewed the impact of ICT on the teaching and learning of science in schools. She indicated that" internet is used in science both as a reference source and as a means of communication" (p.24).New technologies may also help to increase student motivation

(Osborne & Collins, 2000), facilitate clearer thinking and develop interpretation skills with data (Newton & Rogers, 2003).

Another benefit from ICT in science education is that it expands the pedagogical resources available to science teachers (Al-Alwani, 2005). Pickers gill (2003) explored effective ways of utilizing the internet when teaching science. He found that the ease of internet access allows teachers to help students to become experts in searching for information rather than receiving facts (p.86). Kelleher (2000) reviewed recent developments in the use of ICT in Science classrooms. While he wrote that ICT cannot replace normal classroom teaching, the review indicated that ICTs could be positive forces in science classrooms for a deeper understanding of the principles and concepts of science.

The new ICTs have other potential benefits as tools such as those for data capture, multimedia software for simulation etc for enhancing science teaching and learning in schools (Skinner & Preece, 2003). However, current research would suggest that it is not appropriate to simply assume that the use of ICT will necessarily transform science education.

**3. Different uses of ICT-enabled learning**

Many different uses of ICT in education are possible. These range from using ICT as tools to support traditional ways of teaching to fully ICT-enabled courses that entail a completely different way of teaching. It throws light on the question of whether ICT should be a supplementary tool or an enabler of change and innovation. In its report on the use of eLearning in tertiary education, the OECD (2005) distinguishes four different levels, depending on how prominent the eLearning tools are in courses:

• *Web-supplemented courses* focus on classroom-based teaching but include elements Such as putting a course outline and lecture notes online, use of e-mail and links to On line resources.

• *Web-dependent courses* require students to use the Internet for key elements of the programme such as online discussions, assessment, or online project/collaborative Work, but without significant reduction in classroom time.

• In *mixed mode courses*, the e-learning element begins to replace classroom time. Online discussions, assessment, or project/collaborative work replace some face-to-face Teaching and learning.

• In *fully online courses*, students can follow courses offered by a university in one city From another town, country or time zone.

The types of e-learning offered by universities range right across the e-learning spectrum, but in most campus-based institutions, the growth of e-learning has not altered the fact that face to-face classroom teaching remains central. Contrary to the predictions, distance online learning in general and cross-border e-learning by students outside the country where the institution's central campus is located have yet to emerge as significant activities. In most institutions, cross-border enrolments for e-learning are small-scale, peripheral activities and fully online courses account for less than 5% of total enrolments. Most e-learning activity is thus related to modules, or segments of a course, reflecting the dominance of e-learning as supplementary tool (OECD 2005). It seems that ICT has indeed had more impact on administrative services such as Admissions, registration, fee payment and purchasing than on the fundamentals of classroom Teaching and learning. As a result, the OECD (2005) concludes that eLearning has not really Revolutionized learning and teaching.

The OECD has also investigated student performance at secondary level, providing evidence of the impact of ICT on concrete school achievements. Based on the OECD's PISA 2003 assessment of educational performance by 15-year old students, it has shown that regular Computer users perform better in key school subjects compared to those with limited Experience with computers or to those that lack confidence in their ability to perform basic Computer functions. Moreover, it seems that availability and use of computers outside the School environment, i.e. at home - and even accounting for differences caused by socioeconomic Status - is a more determinant factor for school achievement than the use of computers at

school. The ELNORD (2006) study also found that pupils at home use ICT for educational purposes, as a collaborative tool. They use e-mail, chat and mobile phones to communicate with classmates, giving and receiving help when doing their homework.

## 4. Teacher- Training and ICT

The need for teacher training is widely acknowledged. Teachers, trainers, and other learning facilitators have to be given the knowledge, examples and time to "adopt" ICT in their daily practice. Empowering teachers and trainers is therefore fundamental (HELIOS 2006: 16; Cartelli, 2006). One of the problems is that today's teachers need to learn to teach with digital technologies while many of them have not been taught to do so. Teacher training should not just encompass ICT skills but rather a full understanding and complete mastery of ICTs as pedagogical tools.

The Future lab study reveals positive results from a review of a number of UK case studies on teacher training. Although they are not representative, most of these case studies highlight positive impacts of teacher training with digital technologies, such as increasing teacher confidence and competence in the use of IT resources by providing them fully equipped multimedia portable computers (MPTP) (Fisher et al 2006: 27-28) or by supporting online teacher communities.

## 5. Barriers to the integration of ICT into teaching and learning

The act of integrating ICT into teaching and learning is a complex process and one that may encounter a number of difficulties. Different categories have been used by researchers and educators to classify barriers to teacher use of ICT in classrooms.

Several studies have divided the barriers into two categories: extrinsic and intrinsic barriers. Ertmer (1999) referred to extrinsic barriers as first order and cited access, time, support, resources and training and intrinsic barrier as second order and cited attitudes, beliefs, practices and resistance; whereas Hendren (2000, as cited in Al-Alwani, 2005) saw extrinsic barriers as pertaining to organizations rather than individuals and intrinsic barriers pertaining to individuals, teachers and administrators.

Another classification found in literature is teacher- level barriers versus school -level barriers. Becta (2004) grouped the barriers according to whether they relate to the individual (teacher-level barriers), such as lack of time, lack of confidence and resistance to change, or to the institution(school-level barriers) such as lack of effective training in solving the technical problems and lack of access to resources. Similarly, Balanksat et.al (2006) divided them into micro level barriers, including those related to teachers' attitudes and approach to ICT, and meso level barriers, including those related to institutional context. The latter added a third category called macro level (system level barriers), including those related to the wider educational framework.

Another perspective presents the obstacles as pertaining to two kinds of conditions: material and non-material (Pelgrum2001). The material conditions may be the insufficient number of computers or copies of software. The non-material obstacles include teachers' insufficient knowledge and skills of ICT, the difficulty of integrating ICT into instruction and insufficient teacher time.

## Conclusion

This paper provides an insight into the challenges faced by policy makers, educational institutions, course developers, and learners dealing with issues of access to education through ICT. It is necessary to take a broad view in order to understand and determine how ICT impacts on learning. This is because educational achievements are shaped not only by the way educationist organized but also by the socio-economic background of the learners, their socio-cultural environments, the changing skills and competences that are necessary for employment, education and training, self-development and participation in society. This clarifies partly why non-formal learning, informal learning and adult learning are increasingly seen as crucial for the future of learning. There is evidence that educational achievements are positively influenced by ICT, but not only by ICT used at school. Indeed, it seems that experience with ICT at home, in particular the computer, is a more important factor for school achievement in certain cases than the use of computers at school. However, it is still the case that access and use of computers

at home is shaped by socio-economic differences. Thus the socio-economic background of students continues to be important for their educational achievements. On the contrary, there is evidence that it is quite significant, but it depends on how ICT is used in educational institutions. Currently, it seems that ICTs are used as tools to support and improve the existing learning process and its administration more than for their transformative potential. ICT has not been able to revolutionize learning and teaching. Moreover, progress is still needed in providing attractive learning content and learning technologies. The paper indicates that the use of ICT for learning is most widespread in tertiary education, followed by ICT usage in schools and for vocational education and training. The use of e-Learning for continuous training and lifelong learning is regarded as low, although this does not take into account the growing fields of informal and non-formal learning.

The paper has identified significant challenges developing countries face when attempting to make learning more accessible by using Internet technologies. To meet the demand of the present era, in the field of technology it is recommended to make its application more effective in education, students must be trained in IT from the grass root level. Therefore, Information and communication technology (ICT) must be introduced as a separate discipline in the curriculum from primary level. To promote ICT in education at secondary level

and for students to become more familiar with the use of ICT, libraries in the educational institutions may be converted to on-line libraries. As the students from the poor families do not have the IT facilities available at their homes, so to make the use of ICT effective in the teaching-learning process the vital role of teachers in this process may be enhanced by giving them in-service training for the use of technology. For the same reason mentioned above, application of ICT might be included as an integral part of the syllabi for before- service teacher training degree program, and also at the time of induction of new teachers in any educational institution.

In the twenty first century, technology has taken its place in almost all fields of life including education. The young generation is becoming familiar with its use, since they have understood that it is the demand of the present era, but old people think that they can spend their rest of lives without using technology as they have almost spent a major portion of their lives without using technology. Therefore, special training programs of use of technology for old teachers should be designed to remove their shyness for the use and understanding of ICT in the educational institutions. Computer laboratories in the educational institutions at secondary and higher secondary levels might be equipped with sufficient number of computers connected with Internet and Web.

**REFERENCES**

Al-Alwani,  A. (2005) Barriers to integrating Information Technology in Saudi Arabia Science Education, Doctoral Dissertation, The university of Kansas, Kansas.

Balanskat, A., Balamire, R., &Kefala, S., (2006) A review of studies of ICT impact on schools in Europe. European  school net.

Pickersgill, D. (2003) Effective use of Internet in science teaching.School science review, 84(309), 77-86.

Pelgrum, W. J. (2001) Obstacles to the integration of ICT in education: results from a worldwide educational assessment . Computers and Education, 37, 63-178.

British Educational Communications Technology Agency (Becta) (2003). Primary-schools- ICT and standards. Retrieved june13, 2008.

Kelleher, P. (2000) A review of recent developments in the use of Information and Communications Technologies (ICT) in science classrooms.Australian science Teachers journal, 46(1), 33-38.

Osborne, J., & Collins, S. (2000). Pupils' and parents' view of school science curriculum. London. Kings college, London.

Bransford, j., Brown, A. L., & Cocking, R.R. (Eds.). (2000). How people learn: brain, mind, experience and school (2nd ed.). Washington, D.C.: National Academy Press.

Grimus, M.  (2000, 21-25 Aug).ICT and multimedia in the primary school. Paper presented at the 16th conference on educational uses of information and communication technologies, Bejing, China.

British Educational Communications Technology Agency (Becta) (2004).A review of research literature on barriers to the uptake of ICT by teachers. Retrieved june13, 2008

Skinner, N. C.,  &Preece, P. F. W, (2003). The use of information and communications technology to  support the teaching of Science in schools. International journal of science education, 25(2), 205-219.

OECD (2005) "E-learning in Tertiary Education. Where do we stand?" OECD: Paris.

ELNORD (2006) "eLearning Nordic 2006", Edited by Pedersen, S.G., Malmberg, P.,

Christensen, A.J., Pedersen, M., Nipper, S., Græm, CD., Norrgård, J. &Ramboll

Management. Copenhagen: Ramboll Management.

Ertmer, P.(1999), Addressing first and second order barriers to change. Strategies for technology integration.Educational Technology Reasearch and development, 47(4), 47-61.

Cartelli, A. (ed.) (2006) "Teaching in the Knowledge Society: New skills and instruments for

teachers", Information Science Publishing: Hershy, USA & London, UK.

Daniel, J. S. (1997). Why universities need technology strategies. *Change*, 29(4), 11-17.

Geoghegan, W. H. (1994). Whatever happened to instructional technology? Baltimore, MD: Paper presented at the 22nd Annual Conference of the International Business Schools Computing Association [Online]. Available: http://ike.engr.washington.edu/news/whitep/whg/wpi.htm (July 25, 1997).

Murphy, C. (2006) Teaching and learning primary science with ICT.(P.13-32). Berkshire, England. Open university press.

Newton, L & Rogers, L (2003) Thinking frameworks for planning ICT in science lessons.School science review 84(309), 113-119.

Iding, M., Crosby, M.E., Speitel, T. (2002). Teachers and technology: Beliefs and practices. International journal of instructional media, 29(2), 153-171.

Grabe, M., &Grabe, C.,(2007) Integrating technology for meaningful learning (5th ed.). Boston, NY: Houghton Mifflin.

Shamatha, J, H., Peresseni, D.,&Meymaris, K (2004) Technology supported mathematics activities situated within an effective learning environment theoretical framework. Contemporary issues in technology and teacher education,  3(4), 362-381.

Facer, K and Owen, M (2005), The potential role of ICT in modern foreign languages learning *5–19*. NESTA Futurelab Discussion Paper http://www.nestafuturelab.org/research/discuss/03discuss01.htm