
Integrating Information and Communication Technology in Education: Bottlenecks and Solutions.

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ABSTRACT

This study aims to contribute to the understanding of enhancing of the quality and accessibility of education to the masses through use of Information and Communication Technology (ICT). The paper appreciates the benefits that ICT integration in education can provide. The review reveals that all initiatives have similar constraints like financial and human resources. In addition, the initiatives suffer because of non-technical issues related to technology implementation rather than any major flaws in technology. The bottlenecks that arise in the integration of Information and Communication Technology in education are analyzed. Finally concrete recommendations from earlier studies are suggested to overcome the barriers that arise during the process of integrating ICT in education.

Keywords

Information and Communication Technology, Education, benefits, bottlenecks, solutions

Introduction

We have seen the emergence of a knowledge economy in the world where knowledge is the driver of all economic activities. In such a situation education plays a vital role in the development of the human capital of any country (Cross and Adam, 2007; UNESCO, 2002; Bhattacharya and Sharma, 2007). Also information and communication technology is being closely integrated in all our daily activities (Bhattacharya and Sharma, 2007; Kozma, 2005; Plomp, Pelgrum & Law, 2007; Chandra and Patkar, 2007). It has a significant influence on the educational systems throughout the world and people are trying to find innovative easy to leverage the benefits of integrating Information and Communication Technology in education.

In this paper we explore the bottlenecks as well as solutions that arise during the integration of ICT in education

Bottlenecks in ICT impact

Sharma (2003) mentions that socio cultural factors as well as convenience and utility of ICT based education will lead to its adoption in developing countries. However, there are many other factors and reasons, which may hinder the implementation of ICT in education.

Macro factors

Sharma (2003) and Amutabi and Oketch (2003) state that there is a lack of financial and human resources in developing countries , to successfully implement initiatives like integrating ICT in education. These hurdles include lack of money and equipment, skilled labor, lack of business models and management expertise (Bhattacharya and Sharma, 2007; Chandra and Patkar, 2007). In addition, the technology has to be cost efficient as that will decide whether the initiative will get a go ahead. An obstacle to the spread of technology enabled education is the lack of technological infrastructure in developing countries. This creates many hurdles in the smooth flow of information (Mehta and Kalra, 2006; Bhattacharya and Sharma, 2007; Casal, 2007; Sharma, 2003; UNESCO, 2002; Chandra and Patkar, 2007). Alongwith political and infrastructure barriers, there exists a cultural resistance to technology. (Mehta and Kalra, 2007; Casal, 2007; UNESCO, 2002; Chandra and Patkar, 2007). Low purchasing power and low literacy rate lead to increase in the digital

and information divide (Mehta and Kalra, 2006). Rozan et al (2005) mention that digital divides exist both within countries and regions and between countries. The fact is that huge masses of people do not have access to technology, especially in developing countries. It also affects the way in which ICT is used as a tool for social and economic development (Casal, 2007; Bhattacharya and Sharma, 2007). English is the most widely used language on the internet.. However, considering the existence of more than 7000 languages today, there are large groups of population who still do not relate to the language of the Internet. This creates another barrier in adoption of e-learning. (Rozan et al, 2005; Chandra and Patkar, 2007; Mason, 2000). Brady (2001) states that the unequal access to technology may in fact increase the digital divide as only people who have access to financial resources may afford the privilege of ICT enabled education. In addition, certain bad practices like the overcharging of fees from students and low quality diploma/degrees affect the reputation of distance learning (UNESCO, 2002). Some teachers perceive ICT enabled education as a threat to their profession. They also have the concern that lectures recorded by ICT can expose flaws in their communication skills (Rovai, 2003). Some teachers feel that online education will jeopardize their careers by exposing their limited knowledge about the subjects. However, in reality, only their roles are going to change from a narrator to that of a guide and facilitator. ICT technologies are always a complementary facility to teachers and can never substitute a good teacher (Bhattacharya and Sharma, 2007; Mehta and Kalra, 2006). There exist concerns that distance education may fail on the following fronts:

1. Quality of education may be compromised.
2. It can destroy the special relationships that the instructor enjoys with the students.
3. It can be impersonal, superficial, misdirected, and potentially dehumanizing and depressing and that they can disrupt the interactions that create a learning community (Rovai, 2003).

However, there exists research that has proved that student learning, satisfaction and community feeling is independent of the mode of delivery of the program (Rovai, 2003).

University factors

Duggleby et al (2004) explain the needs and challenges associated with ICT implementation in universities. They are as follows:

1. How to best utilize ICT, given limited organizational experience ;
2. Increasing flexibility of learning to make education accessible to disadvantaged learners; and
3. How to enter the strategic and growing e-learning marketplace.

Collins et al (2001) suggest that there are many factors, which oppose ICT usage for the dissemination of ideas at the university level. They include:

1. Issues of Intellectual property ;
2. Competition between universities.
3. Risks associated with sharing ideas;
4. The value placed on teaching as compared to research within many universities;

The availability of channels for the dissemination of ideas.

“Factors that affect innovation in ICT based education can be grouped into nine main categories: personal initiative, changing scale of teaching, changing student population, push for flexible delivery, development of new content, availability of new tools, support from management, limited academic freedom and student demand” (UNESCO, 2002). There are concerns that there is no proper evaluation or pedagogical framework to support ICT in education. ICT usage in education can also increase the occurrence of problems like plagiarism. Universities may fall in the trap of using ICT just to attract students and faculty and it may not serve any educational purpose. In addition, doubts exist if technology can be made reliable and accessible enough for usage in universities. The quality of the educational software available is sometimes not up to the mark (Collins et al, 2001). In addition, the implementation of ICT initiatives in educational institutes tends to

be haphazard, rigid and crude. Again, lack of funding may prevent universities from taking up ICT initiatives (Cholin, 2005).

Micro factors

Sanyal (2001) explains that providing mere hardware will not support the usage of ICT in education. Soft skills are needed to change the culture as well as the ethos of the education system as students have to adjust to the new educational paradigm in the form of e-learning (Mason, 2000). Tondeur, J. et al. (2007) have concluded that ICT usage in education has an undue focus of developing the ICT skills of students rather than integration in the learning and instructional purposes. They feel that one cause of this problem is the lack of proper communication between the management and the teachers. Thus, a shared vision is necessary in any educational institution for the successful usage of ICT in education.

Lack of time for the principals and the teachers is one of the main causes for the absence of a shared vision on the applications of ICT in the class. In absence of inputs from the faculty, the principal or the ICT coordinator usually initiated a top down strategy for integrating ICT in curriculum (Tondeur et al, 2007; Bottino, 2003; Lai and Pratt, 2004). They also state the fact that the principals thought of themselves as catalysts rather than leaders in the ICT integration in teaching.

Lack of financial resources was also considered the main point for not integrating ICT in the educational institution. Low ICT skill levels of the teachers are a demotivator for them. Hence, the teachers are not innovative in their approach, as they do not have a good attitude towards ICT usage in classrooms (Tondeur et al, 2007). Similarly, Web and Downess (2003) state that changing the attitudes and behavior of teachers is the key in any training course for teachers. This is because the competencies needed for teaching online are very different from teaching in normal classrooms (McGorry, 2003). Most of the times, even if ICT is used in the institution it leads to very superficial changes. It fails to change the curriculum or modify the content, dynamics and methods in which the students are taught (Bottino, 2003). Web and Downes (2003) point out that it is very important to build communities of learners who wish to receive 'just in time' professional development. Such communities can teach each of its members, the requisite technical skills to facilitate learning. In addition, it was found that post the implementation of a web based course, different problems may arise. These include students having inadequate access to technology either due to financial reasons or due to overcrowding during usage of the technological equipment. Further questions were raised about the role of the teacher in the process of distance education as many considered the teacher unnecessary in the process (Brady, 2001). However, DeBourgh (2003) put forth the exactly opposite view that although competence of the technology is important, students are more concerned about the effectiveness and quality of the instruction. Students often perceives that the interaction levels with the instructor will be low in distance education.. Technical aspects like the lack of reliability as well as the delay in answers being given by the faculty due to technological reasons also cause dissatisfaction among the students as well as teachers (McGorry, 2002). There is also a perception that students might be graded based on their technological knowledge rather than the scholarly output. These factors may lead to a high rate of attrition of students from such ICT enabled courses (DeBourgh, 2003). The social and psychological barriers for use of ICT in learning and education are much bigger than the technological barriers. These include perception of isolation among students, feeling that the learning may involve high costs, information overload as well as the fact that the technology might lead to information overload (Mason, 2000).

Recommendations in literature:

Bottino (2003) and McGorry (2002) recommend that the policies for ICT usage in education should move from being technology driven to demand-pull. It should ideally be driven by the needs of the users rather than the availability of the technology.

The complex task of integrating ICT into educational processes depends on the following critical success factors:

(1) Shared Vision on education and the teaching/learning process

(2) Knowledge and skills of the faculty;

(3) Availability of content for educational purposes and

(4) The hardware infrastructure

(Plomp et al, 2007; Cross and Adam, 2007; Bottino, 2003; Mason, 2000).

Similarly, the following practices have to be kept in mind in e-education:

1. Need to limit the online material
2. Need to structure online material.
3. Need to emphasize online discussion.

A balance of independent and collaborative activities (Mason, 2000).

Governments, the private sector and NGOs need to work together to lay the foundations for an information, for successfully integrating ICT in education.(Cross and Adam, 2007; Mehta and Kalra, 2006).

Literature suggests that the distance education can be as effective as traditional education subject to the following conditions:

1. Appropriate choice of technology and methods as per situation;
2. Student to student interaction and learning;
3. Timely feedback from teachers to students (Rovai, 2003).

It has also been observed that students have positive perceptions about the Internet as well as the facility of online courses. This is also because of the fact that students learn more about the Internet as a tool for usage in workplace if they are exposed to it through the medium of education (McGorry, 2002)

Tondeur, J. et al. (2007) have found that their study validates earlier research that the school level factors play a central role while a change is taking place via ICT usage.

Strategies should be used to target ICT usage among the disadvantaged sections of the society. This would ensure inclusion of all left out sectors as well as bring greater focus to the ICT strategy (Sharma, 2003; Cross and Adam, 2007; Casal, 2007; Amutabi and Oketch, 2003). To include the disadvantaged segments, the ICT used has to be low cost and user friendly. This can be achieved through the four pronged approach of low cost hardware, open source software, localization of content and use of technologies such as wireless internet. Similarly using technologies like text to voice technology can help overcome the literacy barrier for usage of ICT. To lower costs, recycling of older computers dumped from developed countries can be done. Similarly, innovations like simputer and use of alternate sources of energy like solar and wind power can be explored (Mehta and Kalra, 2006).

ICT channels have to be innovatively thought out. In developing countries like India where PC, television and internet penetration is very low as compared to radio, high quality FM spectrum can be used to disseminate educational news and content (Sharma, 2003). Websites, email, list servers, discussion boards, mailing lists, networking, online professional development courses are channels that can be effectively leveraged for the use of dissemination of teaching and learning innovations (Collins et al, 2001; Amutabi and Oketch, 2003). The ICT initiatives have to be available to the end user in vernacular formats with high degree of visual communication to overcome the illiteracy barrier (Chandra and Patkar, 2007). Awareness about the benefits and the simplicity of such ICT initiatives has to be created by use of mass media. Computers and facilities used in education can also be used as community service centers to increase their productivity (Mehta and Kalra, 2006).

The importance of school improvement related aspects in implementation of ICT in educational practices has been demonstrated. Leadership and vision are as important as any other factor. Such a vision must be a shared concept between the principals (the leaders) and the implementers (the teachers) (Otto and Albion, 2002). Policy decisions and change models fail to acknowledge the pivotal role of teachers in implementing ICT

related changes. There should be a dialogue on the same, among all the important stakeholders such as teachers, principal and students (Tondeur et al., 2007).

Several studies support that leadership is a key factor in implementing ICT integration in education as it focuses on promoting use of ICT at a strategic and action level. It is also found that leaders (principals) who have been exposed to some degree of ICT training generally act favorably and positively towards ICT integration in education. Hence, training of principals should be a priority (Tondeur et al, 2007). ICT integration in education involves an organizational change and hence a strong strategy is required to carry out that change (Bhattacharya and Sharma, 2007).

DeBourgh (2003) states that the best predictors of student and instructor satisfaction in case of distance education were the level of technology competence and their comfort levels with technology.

The focus of ICT coordination should be on the curriculum integration rather than on technical matters (Lai and Pratt, 2004). Hence, there should be a greater emphasis on ICT support in all schools. A rigorous monitoring and evaluation of the projects should be done (Bhattacharya and Sharma, 2007). This would enable people to learn how to overcome bottlenecks and to learn best practices (Sharma, 2003; Mehta and Kalra, 2007).

Continuous revision and evaluation of the distance education programs is necessary for short term and long term success. The benefits of such evaluation are:

1. Accountability for the teachers;
2. Identification of weaknesses in the program;
3. Assessing effectiveness;
4. Program modification and renewal if necessary.

Such evaluation can be carried out on four parameters namely quality of the program, the quantity of the output, the credibility and the cost effectiveness of the program. The measures should be focused on parameters such as the inputs, the process, the outputs and the impact of the educational program (Rovai, 2003).

Cooperation and sharing of best practices among schools should be a part of the policy adopted by the school (Mason, 2000). This should take place under leadership and have the facilitating condition of internal support and periodic evaluation. An example is the Ed-ex initiative which is a collaboration among some of the top educational institutes among the world to offer high quality web based courses. Tondeur et al (2007) state that improving the informal culture and policies in an educational institution can go a long way in helping ICT integration.

Collins et al (2001) put forth the following suggestions to increase and optimize dissemination of teaching and learning innovations:

1. Identify self and others as innovators and share ideas;
2. Participate in education dissemination programs set up by the institution;
3. Incorporate teaching in research activities;
4. Employ interactive rather than passive teaching methods.

In-classroom provision of computers maximizes usage-potential. When the computers are kept in the lab, they are usually allocated by time-sharing and other constraints. This creates a gap between the availability and the actual usage of the computers. It also reduces the chances of integration of ICT in the classroom (Tondeur et al, 2007). Instructors must design and use strategies to involve students at remote sites in active learning early in the distance-education experience so as to reduce the perceived social distance between the two (DeBourgh, 2003).

The government should also be open to the idea of opening up the education sector, especially higher education in order to improve quality by increasing competition. This should facilitate institutions operating on national and international scale. This would also inspire organizational change among public institutions

(Cross and Adam, 2007). Several infrastructure hurdles like electricity and computer resources can be overcome by means of actively engaging the private sector in partnerships (Arora, 2007; Cross and Adam, 2007; Casal, 2007). Emergence of specialized private universities to cater to niche segments will also be seen. The roadmap for greater spread of ICT enabled education includes developing policies for institutional accreditation and assessment, certification of learning, intellectual property rights, and incentive structures like tax breaks, subsidies etc. Standardization can help bring down costs dramatically (UNESCO, 2002).

Summary and conclusions

In the knowledge economy, education plays a vital role in development of an individual as well as the progress of a society. With rapid development in the Information and Communication Technologies, there is an need to leverage the technologies to promote the quality and accessibility of education. Such integration of technology in education provides significant benefits to all the stakeholders involved in the education system. It facilitates accessibility of education by overcoming of time and space barriers as well as it allows for sharing of best practices throughout the world. However any change in traditional systems always meets with resistance. Bottlenecks are present at macro, university and at micro levels too. Macro level factors include lack of technological infrastructure, cultural resistance to technology as well as the presence of multilingual populations that are not familiar with the English language. Cost of the technology is another factor that hinders the spread of information and communication technology. At the university level there exist concerns that technology may compromise intellectual property of the stakeholders. Again there exist risks that the implementation of technology might not be a smooth process. At the micro level, there exist financial and human resource constraints. Similarly there does not exist any proper pedagogical framework for teachers to teach using technology as a tool.

To overcome such barriers in integrating technology in education, the literature has many recommendations. These include building the necessary hardware and software infrastructure to facilitate the spread of technology. Experts suggest public private partnerships to overcome the lack of funds and expertise. Similarly best practices in teaching have to be shared among the various universities and schools. The technology has to be chosen as per the situation and a coherent vision has to be developed, which takes into consideration the views of all the stakeholders. Adequate technical support has to be made available to the teachers as well as timely feedback has to be ensured to take corrective steps if necessary in the rollout of the technology. The integration of technology in education not only involves technological factors but also involves organizational change which has to be looked after as well. Hence school policies should include a vision statement outlining the role that technology will play in the learning process.

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