

Enhancing the quality and accessibility of higher education through the use of Information and Communication Technologies.

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Abstract

Changes in the economic and social fundamentals call for transformation in the skills, capabilities and attitudes of the masses. This requires a shift in the delivery and pedagogy used in the current education system. The purpose of this paper is to promote integration of Information and Communication technologies (ICT) in higher education for imparting easily accessible, affordable and quality higher education leading to the economic upliftment of India.

The focus of the paper is on the benefits that ICT integration in education can provide, right from breaking time and distance barriers to facilitating collaboration and knowledge sharing among geographically distributed students. The findings reveal that it also facilitates sharing of best practices and knowledge across the world.

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 contribute to the industry. It can improve the quality of learning and thus contribute to the economy. It provides several tangible and intangible benefits for all stakeholders involved in the economic growth of the country.

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. 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. The paper also explores the factors related to policy, planning, technical requirements as well as the training required for the stakeholders for the successful implementation of ICT in an education system. These steps would ensure that accountability, quality assurance, accreditation and consumer protection in ICT based education is taken care of.

Enhancing the quality and accessibility of higher education through the use of Information and Communication Technology.

India, like any other knowledge economy, depends on the development of its educational sector. Higher education drives the competitiveness and employment generation in India. However, research findings have shown that the overall state of higher education is dismal in the country. There is a severe constraint on the availability of skilled labor (Agarwal, 2006). There exist socio-economic, cultural, time and geographical barriers for people who wish to pursue higher education (Bhattacharya and Sharma, 2007). Innovative use of Information and Communication Technology can potentially solve this problem.

Education is the driving force of economic and social development in any country (Cholin, 2005; Mehta and Kalra, 2006). Considering this, it is necessary to find ways to make education of good quality, accessible and affordable to all, using the latest technology available.

The last two decades have witnessed a revolution caused by the rapid development of Information and Communication Technology (ICT). ICT has changed the dynamics of various industries as well as influenced the way people interact and work in the society (UNESCO, 2002; Bhattacharya and Sharma, 2007; Chandra and Patkar, 2007). 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).

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).

The challenges before the education system in India can be said to be of the following nature:

Access to education- There exist infrastructure, socio- economic, linguistic and physical barriers in India for people who wish to access education (Bhattacharya and Sharma, 2007).

Quality of education- This includes infrastructure, teacher and the processes quality.

Resources allocated- Central and State Governments reserve about 3.5% of GDP for education as compared to the 6% that has been aimed (Ministry of Human Resource Development, 2007).

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).

Table 1: Participation of Indian students in education.

Stage of education	Gross Enrolment Ratios (2003-04)
Elementary	85%
secondary	39%
tertiary stages of education	9%

(Source: Department of Higher Education, 2007)

Thus, the participation rates of the Indian population in education, and especially in higher education are quite low.

In the current Information society, there is an emergence of lifelong learners as the shelf life of knowledge and information decreases. People have to access knowledge via ICT to keep pace with the latest developments (Plomp, Pelgrum & Law, 2007). In such a scenario, education, which always plays a critical role in any economic and social growth of a country, becomes even more important. Education not only increases the productive skills of the individual but also his earning power. It gives him a sense of well being as well as capacity to absorb new ideas, increases his social interaction, gives access to improved health and provides several more intangible benefits (Kozma, 2005). The various kinds of ICT products available and having relevance to education, such as teleconferencing, email, audio conferencing, television lessons, radio broadcasts, interactive radio counseling, 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).

Table 2: The four main rationales for introducing ICT in education:

Rationale	Basis
Social	Perceived role that technology now plays in society and the need for familiarizing students with technology.
Vocational	Preparing students for jobs that require skills in technology.
Catalytic	Utility of technology to improve performance and effectiveness in teaching, management and many other social activities.
Pedagogical	To utilize technology in enhancing learning, flexibility and efficiency in curriculum delivery

(Source: Cross and Adam (2007).)

Today ICTs—including laptops wirelessly connected to the Internet, personal digital assistants, low cost video cameras, and cell phones have become affordable, accessible and integrated in large sections of the society throughout the world. It can restructure organizations, promote

collaboration, increase democratic participation of citizens, improve the transparency and responsiveness of governmental agencies, make education and health care more widely available, foster cultural creativity, and enhance the development in social integration (Kozma, 2005). It is only through education and the integration of ICT in education that one can teach students to be participants in the growth process in this era of rapid change.

ICT can be used as a tool in the process of education in the following ways:

- **Informative tool:** It provides vast amount of data in various formats such as audio, video, documents.
- **Situating tool:** It creates situations, which the student experiences in real life. Thus, simulation and virtual reality is possible.
- **Constructive tool:** To manipulate the data and generate analysis.
- **Communicative tool:** It can be used to remove communication barriers such as that of space and time (Lim and Chai, 2004).

The following mediums are used for the delivery and for conducting the education process:

- Voice – Instructional audio tools that include interactive technologies as well as the passive ones.
- Video - Instructional video tools that include still images, prerecorded moving images, and real-time moving images combined with audio conferencing.
- Print – instructional print formats that include textbooks, study guides, workbooks and case studies.

(Bhattacharya and Sharma, 2007; National Programme on Technology Enhanced Learning, 2007).

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).

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).

E learning has the following advantages:

- Eliminating time barriers in education for learners as well as teachers (Sanyal, 2001; Mooij, 2007; Cross and Adam, 2007; UNESCO, 2002; Bhattacharya and Sharma, 2007);
- Eliminating geographical barriers as learners can log on from any place (Sanyal, 2001; Mooij, 2007; Cross and Adam, 2007; UNESCO, 2002; Bhattacharya and Sharma, 2007);
- Asynchronous interaction is made possible leading to thoughtful and creative interaction (Sanyal, 2001; UNESCO, 2002; Bhattacharya and Sharma, 2007);
- Enhanced group collaboration made possible via ICT (Plomp et al., 2007; Sanyal, 2001; Bhattacharya and Sharma, 2007);
- New educational approaches can be used. (Sanyal, 2001);
- It can provide speedy dissemination of education to target disadvantaged groups (UNESCO, 2002; Chandra and Patkar, 2007);
- It offers the combination of education while balancing family and work life (UNESCO, 2002; Bhattacharya and Sharma, 2007);
- It enhances the international dimension of educational services (UNESCO, 2002);
- It allows for just in time and just enough education for employees in organizations (UNESCO, 2002).
- It can also be used for non-formal education like health campaigns and literacy campaigns (UNESCO, 2002).

E learning allows higher participation and greater interaction. It challenges the concept that face-to-face traditional education is superior to it (Bhattacharya and Sharma, 2007). The web and the Internet is the core ICTs to spread education through e-learning. The components include e-portfolios, cyber infrastructures, digital libraries and online learning object repositories. All the above components create a digital identity of the student and connect all the stakeholders in the education. It also facilitates inter disciplinary research (Chandra and Patkar, 2007).

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). Casal (2007) mentions that ICTs also provide a platform for sharing information and knowledge. This can be used for the betterment of program delivery in terms of replication of

best practices. It also helps researchers by provision of information, networking, online journals, libraries and data. The possibility of real time interaction in all the different aspects of the education system like teaching, collaboration, debates etc hold great promise for the future (Mason, 2000).

Evidence through practical experience in the world indicates that investing in an ICT experience contributes mainly to increasing human and knowledge capital, which benefits the industry as well. Employers gain from the increased knowledge and skills of staff without releasing them for long periods (Barratt, 2006). In addition, investment in production of ICT is a more effective tool for development of the whole society (Casal, 2007). Research findings show that technology can support pedagogical, curricular, and assessment reforms, which intend to support the process of knowledge creation. Students and teachers plan their learning activities and build on each other's ideas to create new knowledge. It also facilitates monitoring of their progress in understanding and preparation for lifelong learning and participation in the information society (Kozma, 2005; Bhattacharya and Sharma, 2007). Besides cost effectiveness, research has proved that ICT is most effective to tackle problems like expanding number of students in each class (Fluck, 2003). ICT enabled distance education provides environmental benefits, as there is a major reduction in the amount of student travel. Economies of scale in utilisation of the campus site are generated. Student housing is not needed which further saves costs (Barrat, 2006). However, cost of providing the distance education depends on several factors, which include: geography and communities targeted, breadth of courses and class size. It also depends on the technology used; amount of resources deployed in producing course materials as well as how frequently they are updated.

E-learning allows delivery, dialogue and feedback over the Internet. It allows mass customization in terms of content and exams. E-education can provide access to the best gurus and the best practices or knowledge available (UNESCO, 2002). It is possible to leverage the online environment to facilitate teaching techniques like role-play across time and distance (Wishart, 2007). It can also facilitate the development of scenarios, which can be rarely witnessed in practice. ICT can play a valuable role to monitor and log the progress of the students across time, place and varied activities. Mooij (2007) states that differentiated ICT-based education can be expected to provide greater reliability, validity, and efficiency of data collection and greater ease of analysis, evaluation, and interpretation at any educational level. In absence of ICT, most of the responsibility of teaching and learning lies on the teachers. However, with the help of ICT one can transfer the responsibilities to the students so that they can self manage. It helps to individualize the teaching or guidance method as per the student's need (Mooij, 2007; Ozdemir and Abrevaya, 2007). It also boosts the confidence level and the self-esteem of the students who acquire the ICT skills through the process of being exposed to such kind of learning (Casal, 2007). Mooij (2007) also puts forth the view that ICT-based registration, evaluation, and administration helps to link different levels of information and facilitate an overall view of the whole educational setup. It facilitates the evaluation and examination of the learning process and results by the students and the parents in a flexible and convenient way. The globalization process has also created a large market of offshore students. To reach them, information technology is the only convenient medium, which can offer education as a service (Collins et al, 2001; Bhattacharya and Sharma, 2007). It increases

education provision substantially and can contribute to mass education. It also creates competition among the institutions for providing education and hence improves the quality (Cross and Adam, 2007).

To summarize, the following table shows the main benefits of using ICT in education to the various stakeholders:

Table 3: Benefits of ICT in education to the main stakeholders.

Stakeholder	Benefits
Student	<ul style="list-style-type: none"> • Increased access, • Flexibility of content and delivery, • Combination of work and education, • Learner-centred approach, • Higher quality of education and new ways of interaction.
Employers	<ul style="list-style-type: none"> • High quality, cost effective professional development in the workplace, • Upgrading of employee skills, increased productivity, • Development of a new learning culture, • Sharing of costs and of training time with the employees, • Increased portability of training.
Governments	<ul style="list-style-type: none"> • Increase the capacity and cost effectiveness of education and training systems, • To reach target groups with limited access to conventional education and training, • To support and enhance the quality and relevance of existing educational structures, • To ensure the connection of educational institutions and curricula to the emerging networks and information resources, • To promote innovation and opportunities for lifelong learning.

Source: (UNESCO, 2002)

India is making use of powerful combination of ICTs such as open source software, satellite technology, local language interfaces, easy to use human-computer interfaces, digital libraries, etc. with a long-term plan to reach the remotest of the villages. Community service centres have been started to promote e-learning throughout the country (Bhattacharya and Sharma, 2007). Notable initiatives of use of ICT in education in India include:

- Indira Gandhi National Open University (IGNOU) uses radio, television, and Internet technologies.

- National Programme on Technology Enhanced Learning: a concept similar to the open courseware initiative of MIT. It uses Internet and television technologies (National Programme on Technology Enhanced Learning, India, 2007).
- Eklavya initiative: Uses Internet and television to promote distance learning (EKLAVYA Technology Channel, India, 2007).
- IIT-Kanpur has developed Brihaspati, an open source e-learning platform (Bhattacharya and Sharma, 2007).
- Premier institutions like IIM-Calcutta have entered into a strategic alliance with NIIT for providing programmes through virtual classrooms.
- Jadavpur University is using a mobile-learning centre (Bhattacharya and Sharma, 2007).
- IIT-Bombay has started the program of CDEEP (Centre for Distance Engineering Education Program) as emulated classroom interaction through the use of real time interactive satellite technology (Centre for Distance Engineering Education Programme, India, 2007).
- One Laptop Per Child (OLPC) in Maharashtra (One Laptop Per Child, 2007).

Factors affecting adoption of ICT in education

There is a worldwide need felt for integrating ICT into education in order to improve the pedagogy to reflect the societal change (Plomp et al, 2007). The main goals of ICT adoption in the education field are reducing costs per student, making education more affordable and accessible, increasing enrollments, improving course quality, and meeting the needs of local employers (Ozdemir and Abrevaya, 2007). Low overheads and cost efficiency are attracting many private players in the field of Internet enabled education. This is also being driven by technological advances, competitive pressures and the positive experiences of many early adopters (McGorry, 2002). The main factors that affect the adoption of ICT in education are the mission or goal of a particular system, programs and curricula, teaching/learning strategies and techniques, learning material and resources, communication and interaction, support and delivery systems, students, tutors, staff and other experts, management, housing and equipment, and evaluation (UNESCO, 2002). National vision, supported by coherent strategies and actions is the most important factor in integrating ICT in education. Successful implementation of ICT requires strong national support from government and local support from relevant institutions and education authorities (Cross and Adam, 2007). Sharma (2003) explains that the political powers of any nations affect the introduction of any new technology. Sharma (2003) and Amutabi and Oketch (2003) explain that cost is an important issue that decides and guides the adoption and growth of Information and Communication Technology especially in developing

countries. Ozdemir and Abrevaya (2007) mention that the institutions, which are granted public status and are supported by government funds, as well as those, that are larger in size, are the ones to adopt the new technologies to support education. However, it is also observed that since technology adoption involves high fixed costs, institutes, which implemented such technology, did not upgrade it as time progressed. The presence of an ICT champion is necessary at all levels of the system. The strong presence of such leadership is evident wherever ICT integration has been initiated successfully (Mason, 2000). Along with ICT training, one needs an ICT related support mechanism to gradually induce the integration (Lai & Pratt, 2004). This is needed as many teachers in face of technical difficulties may tend to revert to the older teaching (non-ICT based) methods. Teachers need support in using and integrating ICT into the curriculum and teaching methods (Lai & Pratt, 2004; Amutabi and Oketch, 2003; McGorry, 2002). Teachers, who perceive greater ICT-related support being available to them, use technologies in their teaching much better (Tondeur et al, 2007).

Potential drawbacks of using ICT in education

Although ICT offers a whole lot of benefits there are some risks of using ICT in education which have to be mitigated through proper mechanisms. They are:

1. It may create a digital divide within class as students who are more familiar with ICT will reap more benefits and learn faster than those who are not as technology savvy.
2. It may shift the attention from the primary goal of the learning process to developing ICT skills, which is the secondary goal.
3. It can affect the bonding process between the teacher and the student as ICT becomes a communication tool rather than face to face conversation and thus the transactional distance is increased.
4. Also since not all teachers are experts with ICT they may be lax in updating the course content online which can slow down the learning among students.
5. The potential of plagiarism is high as student can copy information rather than learning and developing their own skills.
6. There is a need for training all stakeholders in ICT.
7. The cost of hardware and software can be very high.

(PHS-ICT-AS, 2008)

Summary and conclusions

Changes in the curriculum do support fundamental economic and social transformation in the society. Such transformations require new kinds of skills, capabilities and attitudes, which can be developed by integrating ICT in education. The overall literature suggests that successful ICT integration depends on many factors. National policies as well as school policies and actions taken have a deep impact on the same. Similarly, there needs to be an ICT plan, support and training to all the stakeholders involved in the integration. There needs to be shared vision among the various stakeholders and a collaborative approach should be adopted. Care should be taken to influence the attitudes and beliefs of all the stakeholders.

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 enable development of collaborative skills as well as knowledge creation skills. This in turn would better prepare the learners for lifelong learning as well as to join the industry. It can improve the quality of learning and thus contribute to the economy.

Similarly wider availability of best practices and best course material in education, which can be shared by means of ICT, can foster better teaching. However there exist some risks and drawbacks with introducing ICT in education which have to be mitigated. Successful implementation of ICT to lead change is more about influencing and empowering teachers and supporting them in their engagement with students in learning rather than acquiring computer skills and obtaining software and equipment. Also proper controls and licensing should be ensured so that accountability, quality assurance, accreditation and consumer protection are taken care of. ICT enabled education will ultimately lead to the democratization of education.

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