

Information and Communication Technologies for Development in Education

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Innovation distinguishes between a leader and a follower.

Steve Jobs

ABSTRACT In order to foster meaningful development it is essential that people understand both how to use ICTs and the benefits that ICTs can provide to their country and region, because technology is becoming increasingly important in both our personal and professional lives, and our learners are using technology more and more. Universities are compelled to be innovative and lead by using cutting-edge technology to meet youth expectations. The objectives of paper are to consider three major issues of ICTs for development in education: ICTs' potentials, higher education and teacher training, and to show innovative solutions and challenges which provide us high technologies. The importance of large-scale reform in educational policies and practices and in the understanding of the role of ICTs in education cannot be stressed enough. Real learning gains and improvement in an educational system will only come when all the elements of educational change, from policies and practices, to teachers and learners come together in a partnership to benefit from the potential offered by the ICTs.

Keywords: Information and Communication Technologies, education, development, higher education, teacher training.

Introduction

In the twenty-first century, information and communication technologies (ICTs) have become vital tools for developing innovative solutions to development challenges. The use of ICTs provides equitable access to information, knowledge and education for the poor and the rich in developing and developed countries and it gives us opportunities to enrich our lives by positive developments in print, broadcast (radio and TV), digital (computer and Internet), mobile technologies. In such circumstances, education plays an important role in the ICT development as the main source of valuable human capital. Because the students in future assume the roles of policymakers and key decision makers in government, academia, private sector and civil society, they recognize and leverage the link between ICTs and developmental goals. By using ICTs students gain valuable knowledge and insights and also the inspiration to harness their own creativity and energy along with the power of technologies to change this world for the better. The world today is very different from what it was even twenty years ago.

Today, it best fits the description of a global village, where everyone can be connected irrespective of time, space, culture, language and distance. ICTs have created new opportunities to enhance the reach and quality of education. The objectives of paper are to consider three major issues of ICTs for development in education: ICTs' potentials, higher education and teacher training, and to show innovative solutions and challenges which provide us high technologies. The accelerating shift to high technology and information technology economy requires sustained human resource development and training. Driven by globalization and pressures to teach and train knowledgeable, skilled and competitive professionals, education faces a huge challenge in increasing access to education and improving the quality of education against the stark reality of decreasing resources. Without doubt, the demands of the 21st century will pressure more education to modernize its systems and practices.

Numerous studies of technology implementation in organizations in the 1950s (Nancy Law, Allan Yuen, Robert Fox, 2011, p.114) were followed by a number of policies on information and communication technology (ICT) in education in many countries (Pelgrum et al., 1999; Yuen et al., 2010). The early 1970s were marked with higher education institutions' engagement in ICT-mediated administration and management in areas such as "student admission and records, examination results and transcripts, finance database, human resources database and management information" (UNESCO, 2009, p. 26). For example, Hosie (1995) describes a quality framework applicable to higher education and examines factors governing the acquisition, storage and retrieval of data pertinent to a human resource information system. He argues that a human resource information system enables an institution to format a profile of its staff in terms of strengths and weaknesses, and thus "the right people will be in the right place at the right time" (p. 35). McClea and Yen (2005) propose a framework for utilizing ICT in university admissions and seek to achieve the improvement in the general admissions process.

ICTs' Potentials in Education

There is often confusion in understanding what the term "ICTs in education" means. In some instances, it has meant "ICT education", that is the creation of a pool of human resources to cater to the growing knowledge society needs. In other countries, the use of ICTs in education has meant "ICT supported education" and this has resulted in a large number of distance learning systems providing learning opportunities and consequently increasing access to education. In still some other cases, the term has meant "ICT enabled education" – essentially meaning the use of ICTs as a primary channel of educational interaction that is e-learning and m-learning. Very rarely has ICT education been understood as ICTD (development) education or the deployment of ICTs to address development goals (Reddi, 2011, p.89). The right to education is well recognized as fundamental, and education is seen as a vital input to addressing issues of poverty, gender equality and health in the Millennium Development Goals (MDGs) by the United Nations by 2015.

This has led to an expansion of demand for education at all levels. Given limited education budgets, the opposing demand for increased investment in education against widespread scarcity of resources puts intolerable pressure on many countries' educational systems. Meeting these opposing demands through the traditional expansion of education systems, such as building schools, hiring teachers and equipping schools with adequate educational resources will be impossible in a conventional system of education. *ICTs offer alternate solutions* for providing access and equity, and for collaborative practices to optimize costs and effectively use resources. Just as there are different pathways to achieving a country's educational goals, different ICTs have different potentials to contribute to the different aspects of educational development and effective learning. Planning for use necessitates an understanding of the potential of various ICTs to meet different objectives. This understanding affects the choices of technologies and the modalities of their use.

The impact of ICTs on education has been second only to their impact on business practices around the world. A quick broad survey of national efforts will reveal that the use of ICTs is as extensive as it is diverse (Singapore Master Plan for IT in Education), ranging from a long history of use of conventional media-radio and TV in countries like China, India and Mexico – to the more recent and very successful use of ICTs in education in Singapore. Decision makers and teachers, who were earlier very

skeptical, now want to know how this innovation will increase access to educational opportunities, what the costs are and what impact there will be on the key issues plaguing developing countries' attempts to address educational issues related to access, equality, resources and quality. Generally, access and equity are enabled by extending reach, while quality of digital content remains the same irrespective of time and distance, and ICT-based systems are cost effective in the long run.

Besides, technologies are means of better communication, better processing and exchange of information, better comprehension of our environments, ICTs have the next opportunities and benefits for development education (figure 1):

Opportunities	Benefits
Access to high quality learning materials irrespective of location	Learning material developed anywhere accessible anywhere
Connectivity between learners	Collaborative learning
Interactivity	Networked ICTs allow interactivity between learners, teachers and learners
Remove spatial constraints	Distance, isolation is no longer a determinant of quality or cost of learning
Management of learning	Admissions, assessment, and certification can be organized lowering costs of educational management

Figure 1. The opportunities and benefits of using ICTs in education

ICTs are emerging and involve in the areas of open learning models (both as distance learning and as knowledge networks), the collaboration and sharing across schools and school systems (Schoolnets), the creation of text and audio-visual resources as “learning objects” (a learning object is a resource, usually digital and web based, that can be used and reused to support learning) available as open educational resources (Open educational resources), and the different ways in which teachers are using ICTs to enhance teaching and learning processes in their classrooms. Adding to the array of applications are the sectors in which ICTs are increasingly being deployed – formal, non-formal, distance and teacher education settings, and for broad educational and specifically instructional purposes.

ICTs in Higher Education

Higher education is a key area to maintain a country's competitiveness in the global economy. As proclaimed in the Communiqué adopted by the participants of World Conference on Higher Education in July 2009, “At no time in history has it been more important to invest in higher education as a major force in building an inclusive and diverse knowledge society and to advance research, innovation and creativity” (UNESCO, 2009). The demand for higher education has accelerated worldwide. Between 1999 and 2008, the number of students enrolled in higher education institutions (HEIs) increased by 65 million, with much of the growth being seen in East Asia and the Pacific (UNESCO, 2011). In fact, the global demand for higher education is predicted to expand from less than 100 million students in 2000 to over 250 million in 2025 (UNESCO, 2011a). This is likely to include the rising numbers of adults who seek to enroll in courses to upgrade their skills and qualifications. The Organization for Economic Cooperation and Development has estimated that participation rates of 40-50 percent in higher education are essential for strong economic growth (UNESCO, 2011a). Despite the impressive statistics, most regions around the world have yet to reach this target. Governments and educational institutions are looking *for innovative ways to increase access to higher education* and improve the quality of their programmes and courses in a bid to improve their competitiveness.

The prevalence of information and communication technology (ICT) and the impact it has made in all aspects of our lives are compelling reasons for HEIs to try to capitalize on 21st century tools and

technologies to address 21st century issues and challenges. This has motivated some HEIs in taking the lead to reshape the landscape of their educational systems as well as teaching and learning practices. Over time, the number of universities embracing new technologies to conduct the business of education is expected to soar. However, many HEIs may require guidance and assistance (Tan, 2011, pp.1-2) in their change process to minimize their teething problems, reduce costs, utilize appropriate technology and tools, and engage staff with proper knowledge and skills. Higher education in the Asia and Pacific region targets at increasing the use of ICT in:

- design and develop curricular contents;
- deliver higher education programmes and courses;
- enhance the learning process; and
- increase the efficiency of the administration and management of educational systems (Ibid).

And Australia, Hong Kong (Special Administrative Region of China), India, People's Republic of China, Republic of Korea and Singapore were commissioned to focus on three main areas:

- Open and distance learning
- Blended learning
- Administration and management (Ibid).

Open and distance learning (ODL) has opened the door to higher education for many students. The burgeoning number of ODL students can be attributed in part to the increasing use of ICT in HEIs, as testified by the educational institutions: (i) Symbiosis Centre for Distance Learning (SCDL) in India has more than 200,000 students from all over India and over 40 countries, with 150 employees and over 400 visiting faculty members; (ii) Shanghai Television University (STVU), an open university in China, serves more than 100,000 teachers and students; and (iii) Korean National Open University (KNOU) is a mega-university for ODL with more than 180,000 students. The flexible teaching and learning system is well suited for students who are unable to attend regular classes, and facilitates self-paced learning (Tan, 2011, p. 2). Even traditional universities are offering distance learning and integrating blended learning to complement their face-to-face classroom settings, for example Queensland University of Technology (QUT), one of Australia's largest public universities hosting 40,000 students and 4,000 staff, and Nanyang Technological University (NTU) in Singapore, a tertiary institution with about 30,000 undergraduate and graduate students (Ibid.).

ICT can be used not only for the delivery of lectures and materials, but also for administration and management purposes. It is clear that administrative functions such as student registration, grades, course schedules and even staffing evaluation, have benefitted from the use of ICT. Particularly ICT widely use in the following key areas in higher education of the Asia and Pacific region: ***website and portal; student information system and services; learning management system; learning materials; administration support and human resource management system. Each of these uses will be highlighted below.***

Website and portal

The HEI's website and portal represent the window to all information about the educational institutions, courses and on-line services. As far as possible, no efforts have been spared to ensure user-friendly navigation and easy access such as one-time login ID authentication process. The website and portal have essentially become the gateway to a virtual campus where staff and students are able to conduct many activities, access information and materials, and interact with each other without having to be physically on campus.

Student information system and services

The student support system is another priority area that strengthens HEIs' online teaching and learning platform. It covers a broad range of items including student registration, personal particulars, admission records, course selection and enrolment, examination timetables, test scores, transcripts and other student-related data. SCDL's Student Care Department and HKU's Student Connect are dedicated to serve the students' needs as well as ease administrative processes. SCDL's placement cell is a

helpful facility that offers assistance to students looking for work opportunities. STVU's enrolment system is an integral part of its digital campus. Students' information is stored in a database which is easily accessible by both students and administrators. STVU has embarked on popularizing the smart card to handle ID recognition, financial services, information services, processes and so on. STVU's advisory service system facilitates students in getting online advice from their instructors on the selection of topics all the way through to completing their theses, freeing them from time and physical constraints. STVU has also implemented a returning student service system to assist students who cannot finish their programmes as scheduled, facilitating the recognition of credits that can be accrued for up to eight years (Tan, 2011, p. 3).

Learning management system

The learning management system (LMS) forms the backbone for designing online courses and managing the classes, assignments and tests. A robust LMS will go a long way in supporting both the instructors and students by ensuring effective interactions between instructors and students, uploading and downloading of lessons and course materials, submissions of assignments and reports, evaluation and grading of examinations. SCDL has customized Moodle, an open source LMS programme, to suit its requirements. STVU's Online Training Centre portal includes many elements, e.g., video tutoring, online counselling and online laboratories. KNOU has a well-developed system with the support of two consortia – Korea Virtual Campus (KVC) with 10 universities and Information Technology Cyber University (ITCU) with 36 universities. QUT's LMS – Online Learning and Teaching – is its first university-wide attempt, with continuous upgrading towards a sophisticated interface, to support blended learning. At the heart of NTU's eLearning initiative is the edveNTUre system using a LMS from Blackboard, and its blended learning model is driven by its commitment to facilitate effective learning through reciprocal communication between human and human or between human and machines. IIMC uses third party vendors to provide the facilities and infrastructure of their virtual classrooms (Ibid.).

Learning materials

To support online education, learning materials must be made available to students anytime and anywhere. Understandably, HEIs with greater resources are able to tap into more advanced technology to deliver their materials, but by and large all of them provide a diverse range of online materials, including real-time and pre-recorded lectures, multimedia courseware, virtual laboratory, videos, MP3 files, library, and so on. For students who have limited or no Internet access, some of these learning materials are also available offline in the form of CDs and DVDs. KNOU students have access to multimedia lectures containing dynamically animated contents produced using a multimedia tool and delivered together with PowerPoint slides. Tutorials are available to facilitate self-paced learning, embedded with advanced learning diagnosis and self-evaluation. To encourage high-order learning, KNOU includes project-based learning together with discussions and seminar sessions, features that are also available in the other HEIs (Tan, 2011, p. 3).

Administration support and human resource management system

An efficient system that handles student affairs and manages programmes and courses is a boon to both administrators and academic staff. At the same time, the HEIs have drawn attention to the utility of ICT for human resource management. SCDL has noted the reduction of overheads and cost savings associated with manpower and administration by relying on ICT solutions. HKU has started a major upgrade of its administration and management system in line with an education reform towards a four-year undergraduate programme in Hong Kong. Expecting an increase in the number of students, courses and staff, HKU has chosen to use Oracle's PeopleSoft software for its new human resource management system to support staff selection, recruitment and appointment, contractual agreements, performance management and staff development and so on (Tan, 2011, p. 4).

The outcomes of utilizing technology for higher education are very encouraging. The collective wisdom of professors and experts collaborating online, not bound by time and space, contributes to the production of high quality teaching and learning resources. Innovative tools and technology, coupled with animated, interactive contents and activities increases students' attention and interests. However, some issues and challenges should be considered by other institutions when designing and implementing their own ICT for higher education plans, such as:

- Lack of support from management;
- Unclear division of function and power;
- Uncoordinated planning and implementation;
- Question of ownership;
- Shortage of trained staff to cope with the diversity of responsibilities and tasks;
- Resistance from staff and reluctance to be re-trained; and
- Insufficient funds for developing, purchasing and implementing ICT.

Some of these issues can be avoided through proper preparation and planning, the recruitment of qualified staff and re-training of the whole range of professionals to smooth implementation of any ICT-based systems. Perhaps, a more compelling factor for the successful development and adoption of ICT in any educational institution is its readiness for e-learning. Korea's ICT infrastructure and standing is the envy of many countries in the region. The Internet, mainly through broadband connections, has reached more than 80 percent of Korean households in 2010 (ITU, 2010). Likewise, Singapore is able to implement sophisticated systems based on its fully established infrastructure and facilities. Australia and China are also well positioned to do the same, but it appears that the level of development is largely dependent on the commitment and resources of individual institutions. India is still working to improve its readiness as a country on the whole. More resource-rich HEIs in India have institutionalized the use of ICT into their systems, but even they have several barriers to overcome before they can achieve their objective to deliver high quality e-education seamlessly. Thereby, the most extensive use of ICTs in education has been in higher education, especially the open and distance learning institutions. These institutions are founded on the premise that the physical distance between teachers and learners can be bridged through the development of high quality learning materials delivered to students through various technology tools. Many follow the model of the Open University of the United Kingdom and can be found in all the countries of South, East and South-East Asia and the South Pacific (The website of the Asian Association of Open Universities lists). Finally, ensuring adequate resources is a common issue for all HEIs, even for countries and universities which are better endowed. Under pressure to excel, be competitive and not be left behind, both administrators and academic staff are constantly reminded that they have to secure funding not only to sustain the progress made, but also for future developments.

ICTs and Teacher Training

If the use of ICTs in formal and non-formal education has a significant impact making education flexible, relevant and effective, its impact upon teachers is great. ICT use calls for a completely new teaching and learning paradigm, one that has to be taken into account at induction and in-service orientation programmes for teachers. Reasons why the context of teaching changes are because first, while there is no substitute for a good teacher, ICTs will make certain teaching resources (static textbooks) obsolete. Second, ICTs will make some forms of assessment redundant. Third, it will become necessary for teachers to encourage critical thinking skills, promote information literacy and accept and integrate collaborative learning practices. Finally, teachers will have to reassess the way in which they meet their students' learning needs.

For all these reasons, teachers need to be empowered to use ICTs so that they can gain the confidence and skills to work in an ICT-driven environment. When large numbers of teachers have to be trained in a short time, the best and most cost effective method would be through the use of ICT-enabled distance education. The success of Singapore's ICT in education effort was largely structured upon the successful training of teachers to work in an ICT-enhanced environment even before com-

puters were placed in schools. Bhutan (a country on the eastern ridges of the Himalayas between India and Tibet, it has important geopolitical significance for these two bordering Asian giants) entered into a partnership with the Singapore International Foundation (SIF). Since 1995, SIF's volunteers from field as IT have made their way to Bhutan to share their skills and knowledge with many of the country's educators and young people. The purpose of SIF is to enrich lives and effect positive change in developing communities to make a better world. The SIF's volunteers systematically introduce ICTs to the school teachers in Bhutan through several training programmes. The effort was synchronized with the deployment of hardware in schools so that post-training teachers would use the technology more effectively. After the first round of teacher training, the second phase saw the integration of ICTs into the curriculum as a pre-requisite for the Bachelor of Education programme (Ellie Meleisea, 2007). Similar efforts are underway in Bangladesh and Nepal where teachers are trained in a range of technologies - from computers to digital cameras (Ibid.). Similar initiatives are underway in countries as different as Mongolia, Samoa and Thailand. Despite the differences, there is a common recognition that without effective teacher training in the use and application of ICTs as part of a teaching and learning process, a major component of educational reform would be left out. China, as part of its long-term educational reform and strategy, has incorporated the training of teachers in the use of ICT tools. Standards have been established, digital resources created for teacher support, and teacher training programmes developed. Four areas of training - attitude and awareness; knowledge and skills; implementation and innovation; and social responsibilities - along with precise indicators - have been developed so that teachers can self-assess their progress (Ibid.).

Conclusion

There are many constraints in the integration of ICTs in the education process. Such constraints pale in comparison to the challenges of educational provision - the need to quickly reach the majority of the poor and uneducated rural populations and to find out how to fund, implement and maintain the educational part of the ICT networks. The issues are not merely those of access, but of equity, relevance and local content. The importance of large-scale reform in educational policies and practices and in the understanding of the role of ICTs in education cannot be stressed enough. Real learning gains and improvement in an educational system will only come when all the elements of educational change, from policies and practices, to teachers and learners come together in a partnership to benefit from the potential offered by the ICTs.

It must be remembered that integration of ICT into higher education cannot be accomplished overnight. It takes years of planning and preparation, refining and retuning the systems. The other thing to keep in mind is the rapid change and development in technology. It is not uncommon to find innovative tools and practices once very much in vogue quickly losing grounds to newer inventions. Any investment made in the now "outdated" technology could therefore be lost - a situation to be avoided at all costs especially in view of limited resources. This certainly creates a dilemma. On the one hand, development of ICT for learning is a long-term project; on the other, the ICT sector advances too fast to permit ponderous consideration and decision making. Clearly, this requires holistic and careful planning, supported by up-to-date information and expert advice that will consider factors such as pedagogy, quality learning, affordability, existing infrastructure and resources, staff capacity and course content development and above all, it is critical to have a vision with clear objectives and strategies based on candid understanding of the institution's strengths, weaknesses and core competencies.

The implications of the findings

Positive ICT policies and investments are clearly beneficial to HEIs in the Asia-Pacific region, even though ICT has not replaced classroom-based modes of learning or teaching. Undoubtedly, ICT can provide greater access for different target learners, and has become a vehicle for enriched pedagogical experiences, particularly for distance educators and learners separated by time and space. Coordinated implementation of new or revised policies will likely require the involvement of outside Ministries

(such as Telecommunications, Trade, Health) and national private and non-government educational boards and agencies (for accreditation and recognition where applicable). The omnipresence of ICT dictates the necessity for all educational establishments to adapt to the changing times. The demand for access to education can be, and has been, boosted by technology.

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