

ICT and Innovative Practices in Higher Education

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Abstract— Information and Communication Technology (ICT) is a vehicle to enhance the quality of the education. As the world is moving rapidly into digital media and information, the role of ICT in education is becoming more important in the 21st century. The opportunities for education arising from developments in information and communication technology are very promising. In recent years, increased computing power, improved wireless and user-friendly technology, and reduced telecommunication costs have contributed to lowering barriers to information access and exchange. 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. ICT increases the flexibility of delivery of education so that learners can access knowledge anytime and anywhere. It can influence the way students are taught and how they learn as now the processes are learner driven and not by teachers. The purpose of this paper is to analyze the integration of Information and Communication Technologies in higher education for imparting easily accessible, affordable and quality higher education leading to the uplift 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 and the paper reports on the changing trends in use of ICTs for instruction in higher education institutions (HEIs).

Index Terms—Education System, Information and Communication Technology, Innovative Classroom Practices, Technological and Pedagogical Changes

1 INTRODUCTION

How can a developing nation consider investments in information and communication technology (ICT) for enhancing its formal and nonformal education systems when most of its people still live in absolute poverty? This question is discomforting for everyone concerned with the intersecting issues of ICT and development (ADB 2004). However, these interests are not contradictory, and raising the educational level of the poor is a long-term solution toward alleviating their economic problems. The impact of educational level on economic development is more pronounced with the recent growth of ICT and its increasing importance in social and economic development. This has profound implications for education—both in how ICTs can be used to strengthen education, and how education can be more effective in promoting the growth of ICT in the Asia and Pacific region (ADB 2004, 2008b). However, education systems have changed very little in response. Without improved efficiencies in their education systems, developing nations will not likely be able to provide the additional human capital required to achieve economic self-sufficiency in the context of a highly competitive global economy that is increasingly based on the electronic transfer and manipulation of information (ADB 2004, 2008b).

standard approach focuses on achievement and curricula, how students understand the courses and obtain their degrees or their marks. However, a more extensive definition deals with competencies, skills and attitudes learned through the education experience. The relationship between the use of ICT and student performance in higher education is not clear, and there are contradictory results in the literature. Earlier economic re- search has failed to provide a clear consensus concerning the effect on students' achievement. The field of education has been affected by ICTs, which have undoubtedly affected teaching, learning and research (Yusuf, 2005). ICTs have the potential to accelerate, enrich, and deepen skills, to motivate and engage students, to help relate school experience to work practices, create economic viability for tomorrow's workers, as well as strengthening teaching and helping schools change (Davis and Tearle, 1999; Lemke and Coughlin, 1998; cited by Yusuf, 2005). The integration of information and communication technologies can help revitalize teachers and students. This can help to improve and develop the quality of education by providing curricular support in difficult subject areas. To achieve these objectives, teachers need to be involved in collaborative projects and development of intervention change strategies, which would include teaching partnerships with ICT as a tool. Mobile technologies and seamless communications technologies support 24x7 teaching and learning. Thus, ICT enabled education will ultimately lead to the democratization of education. Especially in developing countries like India, effective use of ICT for the purpose of education has the potential to bridge the digital divide.

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

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There is no standard definition for student performance. The

Oketch, 2003). There exist infrastructure, socio- economic, linguistic and physical barriers in India for people who wish to access education Bhattacharya and Sharma, 2007). This includes infrastructure, teacher and the processes quality. There exist drawbacks in general education in India as well as all over the world like lack of learning materials, teachers, remoteness of education facilities, high dropout rate etc (UNESCO,2002). Innovative use of Information and Communication Technology can potentially solve this problem. Internet usage in home and work place has grown exponentially (McGorry, 2002). ICT has the potential to remove the barriers that are causing the problems of low rate of education in any country. It can be used as a tool to overcome the issues of cost, less number of teachers, and poor quality of education as well as to overcome time and distance barriers (McGorry, 2002).

People have to access knowledge via ICT to keep pace with the latest developments (Plomp, Pelgrum & Law, 2007). ICT can be used to remove communication barriers such as that of space and time (Lim and Chai, 2004). ICTs also allow for the creation of digital resources like digital libraries where the students, teachers and professionals can access research material and course material from any place at any time (Bhattacharya and Sharma, 2007; Cholin, 2005). ICT eliminating time barriers in education for learners as well as teacher. It eliminates geographical barriers as learners can log on from any place (Sanyal, 2001; Mooij, 2007; Cross and Adam, 2007; UNESCO, 2002; Bhattacharya and Sharma, 2007). Plomp et al (2007) state that the experience of many teachers, who are early innovators, is that the use of ICT is motivating for the students as well as for the teachers themselves. Bottino (2003) and Sharma (2003) mention that the use of ICT can improve performance, teaching, administration, and develop relevant skills in the disadvantaged communities. It also improves the quality of education by facilitating learning by doing, real time conversation, delayed time conversation, directed instruction, self-learning, problem solving, information seeking and analysis, and critical thinking, as well as the ability to communicate, collaborate and learn (Yuen et al, 2003). A great deal of research has proven the benefits to the quality of education (Al-Ansari 2006). Hepp,Hinostroza, Laval and Rehbein (2004) state that the literature contains many unsubstantiated claims about the revolutionary potential of ICTs to improve the quality of education. They also note that some claims are now deferred to a near future when hardware will be presumably more affordable and software will become, at last, an effective learning tool. The challenge in transforming secondary and higher and/or tertiary education is to align them with the demands of a globalized and technology driven world. Moreover, secondary and higher and/or tertiary education systems need to be more flexible and responsive to both local needs and the global environment

of the 21st century (UNESCO 2005).

2. EFFECTS OF ICT ON STUDENTS' PERFORMANCE

The relationship between educational environment, students' characteristics, teachers' characteristics and performance of students and we propose to discuss them

- **STUDENTS' CHARACTERISTICS:** The first body examines the effect of the students' socio- economic characteristics on their educational performance. Initial socio-economic differences are determinant of their achievement (age, gender, family structure, level of parents' education, geographical area, etc.). A large body of literature-refocuses on the relationship between the students' school results and the students' socio-economic characteristics. Pozo and Stull (2006) highlighted the importance of the initial provisions (secondary studies and competence in mathematics) in success at university. The secondary performance also depends on socio-economic variables. The students who come from underprivileged socio-economic environments have worse school performances than the less underprivileged students (Conger et al., 1997; Have- man and Wolfe, 1995; Wilson, 1987). Bratti et al. (2007) show that the differences in student performance can be explained by the differences between the areas in economic terms of structures, regional leisure, type of institutions and the individual characteristics of the students (family and social characteristics).

Jaggia and Kelly-Hawke (1999) included variables concerning school inputs and student's family background in order to test whether these two variables influence student performance. They found that higher levels of spending did not have any consistent relationship with student performance. However, family background was clearly very important in explaining differences in achievement. There seems to be a very close link between the ICT revolution and the socio-economic variables. Family structure, social environment and related variables are not sensitive to ICT, yet ICT may act on secondary education and contribute to better achievement. However, ICT may have an impact on students' motivation. Becker (2000) found that ICT increases student engagement, which leads to an increased amount of time students spend working outside class.

- **EDUCATIONAL ENVIRONMENT:** The second body of economic literature aims to evaluate the impact of the educational inputs on the students' performance, based on educational production functions (Hanusek, 2003; Glen, 2006; Glewwe et al., 2004, Glewwee and Kremer, 2006; Todd and Wolpin, 2003). The starting point was that the more students benefit from the physical environment of education the better is their achievement. Thus, increasing physical investment in education must lead to better results and performance. One

prominent variable in the environment and physical investment is class size. A better higher education environment is correlated with small classrooms. While the theoretical hypothesis seems evident, empirical research is more controversial. On one hand, Krueger (1999) and Angrist and Lavy (2004) provide evidence in favour of the positive and significant effect of small classes. Arias and Walker (2004) conducted an experiment to test the relationship between class size and student performance. They controlled variation in instruction, lecture material, and topic coverage by using the same instructors. Their results were statistically significant showing that small class size had a positive impact on student performance. On the other hand, Hanusek (2003) had already shown that one cannot conclude, without some doubt, that the reduction of class size improves student performance.

Hoxby (2000), using data on the United States, did not succeed in finding an effect of class size on student performance.

- **TEACHERS CHARACTERISTICS:** The third body highlighted the effects of teachers' characteristics on student performance. The influence of the teacher had already been shown in the seventies by research of the process-product type of Rosenshine (1971) and that of Bloom (1979). These studies connected the behaviour of the teacher (process) with the training of the student (produced). In recent empirical studies conducted in the United States, Rivkin et al. (2005) found that teachers in their first or second year of teaching are associated with lower student performance in Texas, but teacher education and qualification have no systematic relationship with performance. Jepsen and Rivkin (2002) obtained similar results using grade-level data from California. Preliminary results from Clotfelter et al. (2003) suggest positive impacts of teacher experience and teacher license test scores on student achievement in North Carolina. Betts et al. (2003) obtained mixed results for teacher characteristics using detailed individual-level data in the San Diego Unified School District. The lack of significant effects for these teacher characteristics should not be interpreted as evidence that teachers have no impact on student performance. Teacher quality, measured by teacher fixed effects, has an important impact on student achievement, according to Rockoff (2004). In addition, Hanushek (1971) and Murnane (1975) found significant impact of classroom fixed effects (i.e. combined impact of teachers and peers). Rivkin et al. (2005) found a major effect of overall teacher effects measured at the grade level. In other words, teacher quality may be important, but it is not well captured by levels of teacher experience, certification, and education.

Recent research has pointed out the importance of transforming teaching in order to integrate ICT effectively. ICT is seen as a catalyst of system, community, school and classroom reform

because it provides opportunities to shift from teacher centred to student centred learning. In turn, ICT could also increase the pedagogical repertoire of teachers. This teacher effect is most likely to improve the outcomes of disadvantaged students because it attends to individual need and provides a variety of curriculum and assessment strategies to promote student capabilities across a range of learning outcomes. In this sense, good pedagogical practice in the use of ICT to enhance the learning of students who are disadvantaged is good pedagogical practice for all students. ICT may have an impact on teacher quality and characteristics, and so student performance and achievement.

Three complementary effects may be observed. First, teachers' actions may be complemented by the use of learning from the Internet. The process of learning is not only based on teachers' materials. Second, teachers are acting as learners in the new setting of education. Teachers learn from peers and also from students. They are co-constructing the courses and are more sensitive to student participation. ICT is transforming the classrooms and focusing learning more on the process. Third and related to the two first points, while initial competence and degrees of teachers remain important, new skills are needed and students' performance seems dependent on the ability of teachers to develop these new competencies and skills. Extended training is needed in this subject in the European Union.

3. RESEARCH METHODOLOGY

The specific types of information needed to conduct a secondary analysis will depend on the focus of study. For this research purpose, secondary data analysis is usually conducted to gain in-depth understanding of the "The role of ICT in Higher Education" initiative. Secondary data review and analysis involves collecting information and other relevant data at various levels of aggregation in order to conduct a requirement analysis of various security standards and mostly the paper is based on the information retrieved from the internet via journals, research papers and expert opinions on the same subject matter.

4. IMPACT OF ICT ON THE TEACHING PROCESS

- ICT Has an edit effect in terms of quality of student work and practical examples through visualisation.
- ICT Improves poor handwriting and languages skills through word processing.
- ICT Equalises individual differences and has particularly dramatic effects for students with special needs.
- ICT Facilitates self-pacing with increased capacities to deal with individual learning styles as students can work at the

pace and intensity suitable to their needs.

- ICT Enables collaborative learning with little indication of the isolated learner.
- ICT Encourages use of peer coaching and peer reviews.
- ICT Develops communication skills and awareness of different audiences.
- ICT Has impact on resource-based learning and access to real world information through the Web.
- ICT Increases information reliability and accuracy adding to authenticity of learning tasks, with realistic and up-to-date information.
- ICT Increases student motivation through hands-on activity, visual representations and improved modes of presentation.
- ICT Encourages independent learning and individual preferences for process, layout, style and format.
- ICT Gives students more control.
- ICT Allows students to produce high quality multimedia products.
- ICT Changes teacher practices, planning tools and assessment rubrics.
- ICT Increases opportunities for classes to evolve and for student experiences to shape outcomes.
- ICT Has motivated students to commit to learn and to participate in learning activities.

ICT Has improved students' quality of work and has given them the confidence to perform enhanced learning tasks. ICT Has allowed students to learn independently, which has enabled more work to be completed.

ICT has a profound impact in classrooms. It adds complexity to a non-linear system. This complexity needs a major change in organisation. Downes (2001) differentiates four levels of use of ICT in the classroom:

LEVEL 1: ICT skills are added into the school programme through a separate ICT subject, while teacher practices in other subjects remain unchanged;

LEVEL 2: ICT skills are integrated into teachers' daily work with some teachers' pedagogical practices and classroom behaviour remaining the same, while the practices of others change more radically;

LEVEL 3: ICT is transformative at the classroom level as it changes content as well as pedagogy (what students learn as well as how they learn it);

LEVEL 4: ICT is transformative at the system level leading to changes in the organisational and structural features of schooling.

Performance is then observed when the institutions reach the third or fourth levels. Most universities are currently working at level one and two, especially universities with scarce or few resources. The usage of computers in classrooms is more often

based on the vision of the teacher and his or her beliefs about ICT. In some cases, when ICT is introduced without changes in organisation this may lead to a decrease in student performance and the outcomes of the education.

From our perspective, organisational change related to ICT and its link to students' performance need to focus on at least four basic principles. First, ICT is collaborative technology and needs to be used as such. Second, ICT allows the personalisation of education and personal services are a key element of ICT in education. Third, universities must be viewed as learning organisations. Fourth, the outcomes of education are changing through ICT and we need to focus more on competencies rather than curricula.

5. THE NEW TREND OF ICT

ICT is based on individual access, personal mobile phones, personal computers etc. as well as the new trend for personalisation of the Web. This implies that the needs and the competencies of students are quite different, and since ICT allows one-to-one learning, a more personalised learning may constitute the future trend of higher education. Better achievement of students is easier to obtain since the learning is personalised and customised. However, this implies a huge change in the format, in the organisation of the classrooms and in the competencies and availability of teachers. This may explain the differences observed in the impact of ICT on the performance of students. Wherever the introduction of ICT is associated with a personalised service for students, performance increases.

6. THE OUTCOMES OF HIGHER EDUCATION

The impact of ICT on the learning process seems to be more important and requires more than looking only to curricula. Improved student outcomes are observed, with regard to: motivation, enjoying learning; self-esteem; ICT skills; collaborative skills; subject knowledge; information handling skills; meta-cognitive skills, etc. In European higher education institutions, while students and teachers seem to be using the new available technologies more and more intensively, organisational designs are changing slowly. The lack of a strategy regarding organisational change, as several studies have shown, leads to a weak impact of the use of ICT on student performance.

7. FLEXIBILITY OF TRAINING

ICT is considered to exploit the flexibility of training. The rhythm of study, the allocation of time and the availability of teachers can allow better articulation between private life/ professional life (studies) as well as a better allocation of time between the various uses. This allows better student performance in pecuniary terms of profits and achievement. There is

also the quality of the training. The teaching support, the availability of resources and the variety of training channels may change following the introduction of the ICT. This would make it possible for students to acquire e-skills and to develop them in the labour market (OECD, 2006). Some go as far as claiming that the use of innovative models of training permitted by the introduction of ICT could make it possible for the students to “carry out team work, to share knowledge and to decrease individualism in order to promote the authorized capital” (Lund in and Magnusson, 2003).

8. CONCLUSION

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

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

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

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