CHAPTER 2

ICT AND DISTANCE EDUCATION-LITERATURE REVIEW

2.1 INTRODUCTION

Student–teacher and student–student interactions in purely asynchronous distance learning courses are much lacking compared to similar interactions found in face-to-face teaching, causing learners to experience feelings of isolation, thus reducing motivation and increasing dropout rates. We used PalTalk, an Internet text and audio chat client from AVM Software, Inc. (New York, NY), to offer the students live virtual classroom sessions within a unit of our online distance learning M.Sc. program in Healthcare Informatics. On-demand replays of audio excerpts from the sessions were also provided to accommodate absenteeism and for student review. Five students completed an evaluation questionnaire. The results highlighted the potential merits of using synchronous conferencing to assist in fostering a sense of belonging to one supportive learning community among distance learners and improve educational outcomes. Students were very positive toward the real-time human interaction and voted for a 95/5 (asynchronous/synchronous percentages) blended delivery approach for a typical unit in our program. They also praised PalTalk’s voice quality and ease of use. This paper presents educational and technological perspectives about this experiment in the form of a state-of-the-art review, without intending to be statistically rigorous.

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However, robust research evidence is still required to convince educators fully about the benefits of synchronous communication tools and help them decide on the most suitable solutions for their particular circumstances (Kamel Boulos, Taylor, and Breton, 2005).
2.2 CONCEPT OF ICT AND DISTANCE EDUCATION

The purpose of this paper aims to bring together the findings and key points from a review of significant part of the available literature associated with ICTs for Education and ICTs in Education. This review set out to identify and evaluate relevant strategies in national and international research and initiatives related to measuring and demonstrating the effective use of ICT for education with regard to the teaching learning process; ICT and quality and accessibility of education; ICT and learning motivation, ICT and learning environment, and ICT to enhance the scholastic performance.

The aim of this paper is to highlight some of the challenges of information and communication technology (ICT) integration in a South African classroom setting. The main focus is on the concept of a digital divide, and how cultural complexity with special emphasis on language can affect the divide in institutes that already have material access to ICT. The study is based on field learning in seventh-grade classes in four primary institutes in Cape Town, South Africa. The learners answered a questionnaire regarding their ICT use and skills, and interviews were conducted with learners, teachers, and principals. In conclusion, it is argued that the challenges of language in South African institutes can exacerbate or maintain the digital divide among learners who are already disadvantaged due to a range of social inequalities. For learners to fully master the use of ICT in today's global knowledge society, it needs to be put in a local context, which includes use in a familiar language. Moreover, it is suggested that greater opportunities for teacher training are needed in order to enhance culturally sensitive and appropriate ICT integration based on local needs and capacity (Gudmundsdottir, 2012).

Despite the fact that education systems have been heavily investing in technology since the early 1980s, international indicators on technology uptake and use in education are missing. For more than 25 years education systems have been able to design and implement policies in this domain without those indicators.

The existing international indicators still mirror the first policy priorities of the early 1980s: securing student access to computers and the Internet in schools. Indicators such as ratios of students per computer or percentage of schools with broadband access, although still a concern in some countries, do not yet provide the most relevant information for today's
policy in the field: how is technology used in schools? Is this use truly supporting the emergence of the learning environment that a knowledge-based society requires?

Certainly, knowledge economies and societies would greatly benefit from a broader set of internationally comparable indicators. These could monitor progress in ICT uptake and unveil important information about use, ranging from issues such as frequency to purpose. If carried out in an international comparable framework they will become an important tool for benchmarking policies and practices across countries and over time.

Our increasingly technology-rich world raises new concerns for education while also expecting schools to become the vanguard of knowledge societies. Firstly, technology can provide the necessary tools for improving the teaching and learning process, opening new opportunities and avenues. In particular, it could enhance the customisation of the educational process, adapting it to the particular needs of the student. Secondly, education has the role of preparing students for adult life, and therefore it must provide students with those skills necessary to join a society where technology-related competencies are becoming increasingly indispensable. The development of these competencies, which are part of the set of the so-called ‘21st century competencies’, is increasingly becoming an integral part of the goals of compulsory education. Finally, in a knowledge economy driven by technology, students who do not master these competencies may suffer from a new form of digital divide that may affect their capacity to fully integrate the knowledge economy and society.

Because of these reasons, most countries have undertaken significant investments to enhance the role of technology in education recently, after some years of less activity immediately after the implosion of the Internet bubble. Many would say that the incorporation of technology in education has lost its status as policy priority number one, although for a number of political reasons investments have not been stopped. In many respects, the principle of ‘build it and they will come’ seems to have taken root, and education systems keep investing in technology based on the belief that, sooner or later, schools and teachers will adopt it and benefit from it. The question that arises then is whether or not these new investments are paying off; is this investment in technology within education systems managing to fulfill its expectations?
Ironically, what countries have been investing in this field has hardly been the subject of any comparison. Therefore, countries can hardly claim that they are investing significantly in this. But even more important than the amount of effort invested, what really presses for an evidence-based policy debate about technology in education is the emergence of new policy concerns. At least some of them, and the corresponding policy discussions, could benefit from more solid and comparable evidence: the emergence of a second digital divide, the need to promote the broad set of 21st century skills, and the still unfulfilled experience of promoting radical change in the provision of school education. First, recent evidence has unveiled that the digital divide in education goes beyond the issue of access to technology. A new second form of digital divide has been identified: the one existing between those who have the right competences and skills to benefit from computer use, and those who do not. These competences and skills are closely linked to the economic, cultural and social capital of the student. This has important implications for policy and practice. Governments should make an effort to clearly convey the message that computer use matters in the education of young students and they should do their best to engage teachers and schools in raising the frequency of computer use to a relevant level. Such an increase could not only be a clear indication of teachers’ and schools’ engagement with the development of 21st century skills and competencies, but it could also report gains in educational performance. In addition, schools should be reminded that they have a crucial role in the development of the cultural capital that will allow students to bridge the emerging second digital divide. Second, the changing needs of economic and social development require a wide range of new skills and competencies, known as the 21st century competencies. These are considered key enablers of responsible citizenship in a knowledge based and technology-pervaded economy. For instance, the recommendation of the European Parliament and the Council on key competences for lifelong learning defines a framework of eight competences considered important for the knowledge society. Digital competence is highlighted as one of the eight key competences. In 2007 the Council identified a framework of 16 core indicators for monitoring progress in the field of education. ICT skills are a core indicator in this framework. Technology is hence expected to play an increasing role in education in the coming years. Last but not least, there is the pending issue of whether or not today’s teaching and learning experience in schools matches what could be expected from a knowledge society. The question is not which technology leads to increased
productivity in education, but which new technology-supported methodologies improve student performance over traditional ones, if any at all, and which other factors intervene. Previous calls have already been made in order to investigate the explicit relationships among technology, instructional strategy, psychological processes and contextual factors. The almost infinite array of methodological possibilities makes this kind of investigation extremely difficult, but not impossible, provided that there is sufficient effort devoted to the accumulation and dissemination of the resulting knowledge base. Such a task might appear overwhelming, particularly as the technological frontier is constantly changing. However, it is worth the effort. And policymakers and researchers cannot be in a position to monitor what is truly going on in schools unless critical indicators about intensity, purpose and context of use of technology in education are available. Therefore it is relevant to assess and compare how education systems are dealing with technology integration in schools — particularly in terms of securing and improving access, enhancing a wide range of educational and managerial uses, and monitoring the effects and impacts on the development of critical technology-related skills and competencies. Such a comparison is not possible in the absence of appropriate indicators which, at the moment, are missing in the international collections already available. Both the European Commission and OECD have recognised the need for reliable indicators in the area of technology in education. OECD has raised this issue in the context of the recently published report *Beyond Textbooks. Digital Learning Resources in the Nordic Countries*. It highlights the need for a comprehensive approach to indicators on technology in education and the difficulties associated with their development and data collection. The same need has also emerged during the analysis of the relationship between technology use and educational performance drawing on PISA 2006 data, which will be published by CERI in 2009. The European Commission has initiated several studies intended to summarise existing and available information in the field.

Other international organisations, such as Unesco, the World Bank and the Inter-American Development Bank, share similar needs and are willing to cooperate in this process. An inter-agency seminar carried out in Korea in July 2009 (1), provided an excellent opportunity to compare priorities and agree on the need to explore further synergies.

ICT (information and communication technologies) in education lives a life at the crossroads between evidence based policymaking, learning and the fast-changing world of
technology. Key stakeholders (politicians, parents, teachers, school leaders) demand evidence of the impact of ICT derived from research, monitoring and evaluation. The challenge for policymakers is (in collaboration with the research community and the educational community) to develop a sustainable knowledge base for ICT in education, in which key indicators and other sources of information are identified, which enables better insight into the use and effects of ICT for learning. I have chosen to discuss the issue of developing benchmarks for ICT in education, because benchmarks are embedded in the evolving knowledge base in this field. This article is structured in four parts. In the first part, I describe the policy backdrop, within which the issue of developing a sustainable knowledge base should be discussed. The second part focuses on the issue of what we have learnt from R & D with regard to the effects of ICT in education. In the third part, I describe the concept of the multi-channel and multi-method knowledge base, before I finish with some remarks on the issue of a systemic approach to benchmarks and other critical components of a knowledge base for ICT in education.

ICT in education has, in recent years, emerged as a policy area. Many countries have developed ICT strategies, either as separate strategies or as strands embedded in national strategies for education or for the development of the information society at large in the country. The strategies and their underlying rationales share many common features. Kozma (2008) has identified important reasons for investing in ICT for education.

- To support economic growth mainly by developing human capital and increasing the productivity of the workforce.
- To promote social development by sharing knowledge, fostering cultural creativity, increasing democratic participation, improving access to government services and enhancing social cohesion.
- To advance education reform, i.e. major curriculum revisions, shifts in pedagogy or assessment changes.
- To support educational management and accountability, with an emphasis on computer-based testing and the use of digital data and management systems.

These features relate the issue of ICT in education to its function in a broader, societal context. The role of ICT in education must also be linked to educational needs. In many countries, the role of ICT is linked to issues of educational attainment and the importance of
ICT for advancing robust learning strategies on the side of the students. A second area is ICT as a tool for the support of personalisation strategies in teaching and learning. ICT can also be used to increase visualisation and variation in many subjects. As a greater proportion of our homes are linked to the Internet, the role of ICT in home/school access is now being exploited. Many children start to use ICT at an early age, and the home and the family are, in many cases, an arena for the initial acquisition of digital skills. Thus, education has a role to play in furthering these skills, based on pedagogical principles. Our educational systems should bear in mind that ICT should be an integral part of learning, in order to provide learners from families with a low socio-economic status with necessary digital skills for learning, work and life in order to avoid digital divides. ICT is not integrated in education for its own sake. A proper integration of ICT in key policy priorities in different countries can be a productive approach in order to secure ICT as a mainstream part of education. In Norway, ICT is not subject to a separate strategy; it is rather embedded in the national curriculum and linked to overall political priorities stated by the government: quality of learning, higher completion rates and students’ well-being and mastery. We have been through a period in which politicians and policymakers have focused on the need for establishing credible proof for the return on investments in ICT. This has resulted in a search for causal relationships between ICT and educational quality, i.e. learning outcomes. As the OECD (2008) has pointed out, this has been difficult to achieve because of the lack of large-scale, longitudinal studies and a lack of methodologies that can capture the complexity of ICT and other elements influencing educational quality. One of the most significant studies to date is the Impact report from 2002 (Harrison et al., 2002). The study shows that ICT leads to statistically significant improvements in some subjects, whereas there are no significant improvements in other studies. The OECD, through its work on the PISA studies, has been able to demonstrate interesting correlations between home access and use of ICT on the one hand and PISA score on the other hand. The relation between ICT use at school and PISA score is fare more complex. So far, these correlations have not been explained. The study ‘E-learning Nordic’ (Ramboll Management, 2006), which looks at the perceived impact of ICT, shows that all stakeholders (students, parents, teachers, principals) believe that ICT can have a positive impact on teaching and learning. The studies and reports mentioned above represent a plethora of studies.
The European School net shows in its meta study on impact studies (EUN, 2006) that there are a number of studies, also related to patterns of use across the technological spectrum. Impact studies cover a wide spectrum between the search for causal relationships between ICT and educational attainment on the one hand and studies looking at the perceived impact of ICT on the other hand. The focus of some studies has been on causality and on quantitative issues regarding ICT use. It is time to review critically whether we have been asking the right research questions. In its first report on ICT and PISA score (OECD, 2004), the OECD states: ‘It is the quality of ICT usage, rather than necessarily the quantity, that will determine the contribution that these technologies make to students’ outcome.’ Instead of looking for causality, we need to ask how we can improve and optimise the use of ICT in teaching and learning, and in doing so we also need to listen to the voices of the learners and the practitioners.

**Multi-channel: ICT in education covers a wide spectrum**

The first pillar of my approach to a sustainable knowledge base is the realization that ICT in education covers a wide spectrum — both thematically and along the administration–pedagogy axis. This is a consequence of the incremental integration of ICT into all domains of education. Kozma (2008) has highlighted this in his work, and he acknowledges that ICT strategies in many countries cut across diverse fields. • Infrastructure development is necessary in order to ensure access to schools, networks and resources for learning. • Teacher training, both initial and in-service, is a prerequisite for the ability of education to use ICT in learning processes.

- Technical assistance is needed both in the administrative as well as in the pedagogical domain.
- Curricula and pedagogical approaches may have to be changed in order to cater for educational change with ICT.
- Content development is necessary in order to facilitate the interactive potential ICT can offer in the teaching and learning process. In my opinion, a multi-channel approach to the knowledge base is necessary in order to be able to ask the right questions and to grasp the plethora of issues related to ICT in education. Let me elaborate on a few issues.
• It is necessary to continue the monitoring of infrastructure development. Although many countries have developed a superb infrastructure, access to ICT is still an issue in many European countries. This is truly the case if you look at access issues on a global scale. The same goes for the need for monitoring the evolving patterns of use. We need to be able to assess the speed of uptake of different technologies for learning as well as assessing the degree of variation across the spectrum of learning technologies. A particular challenge with regard to monitoring the patterns of use is the high degree of technological and cultural diversity that is to be expected in many countries around the globe.

• Gender issues are visible. PISA data show that although the gap between genders is closing, there are still interesting differences to be found with regard to patterns of use. A fairly new dimension regarding gender issues is that it might be just as important to study differences within a gender as between genders.

• Digital learning resources (DLR) are characterized by complexity — a crossroads between pedagogy,

technology, IPR and the marketplace. This is an area which, in my opinion, has been under-assessed, and we need a stronger focus both on benchmarking of digital learning resources as well as a research agenda for DLR and learning.

• For PISA (2003) and PISA (2006), follow-up analysis based on ICT data has been undertaken. In future, the ICT analysis of PISA should be replicated and improved, and the ICT familiarity questionnaire should be updated in order to keep up with the evolving use of ICTs for learning.

• Few countries have developed good methodologies for assessing digital skills among students. Such methodologies should be developed both within and across subjects. Some countries are monitoring both access and use of ICT. The Norwegian ITU Monitor (Arnseth et al., 2007) is a biannual monitor that assesses the status with regard to ICT in Norwegian schools. The following figure shows an example of patterns of use among Norwegian students. The list of topics shows that there are many phenomena in ICT and learning that should be monitored and assessed through a variety of channels, but is this enough? In the next chapter I will elaborate on the need for a multi-method approach in order to ensure a sustainable and systemically coherent knowledge base. A consequence of the increased focus on evidence-based policy making is that national authorities need to move away from anecdotal and
unsystematic evidence of how ICT is being used in education and how it impacts teaching and learning. Such a change of focus highlights requirements of methodology and validity. The multitude of issues at hand, which I have described in the preceding chapter, and the need for diverse approaches indicates that building a sustainable and flexible knowledge base requires a combination of quantitative and qualitative methods. Furthermore, a system of indicators and other input to the knowledge base must be flexible enough to allow for changing patterns of use and the emergence of new technologies for learning. An important question is whether the methods are good enough, and if there is room for improvement. A well-known challenge in educational research and development is to be able to capture the complexity of the learning process. In my view, we need to further explore the potential of ethnographic research and so-called test-bed studies. However, a downside to these approaches is that they are consuming both in terms of time and money. In the last couple of years, we have seen projects in several countries aiming at capturing the voices of the learners. One example of this is the digital generation project, funded by the MacArthur Foundation programme for digital media and learning. The project conveys how children develop engagement, self-directed learning, creativity and empowerment through the use of digital media. Our educational systems need to develop our ability to listen to and reflect on the voices of the learners in order to understand how digital media influence the lives and learning of our children. This topic will be addressed in the second half of the OECD new millennium learners’ project. Digital media play a much bigger role in the lives of our students today than before. A Norwegian report from 2008 (Arnseth et al., 2008) shows that more than nine out of 10 adolescents aged 16 to 19 use social media, and three out of four use social media on a daily basis. This raises the question of whether only ICT use in schools should form the basis of our understanding of digital media and learning. We may have to broaden the scope and include out-of-school use of digital media, given the extensive home use of digital media. This would also acknowledge the fact that the home of youngsters is the first arena for the acquisition of digital skills, albeit an informal, but nevertheless important arena. Have divided them into first, second and third order benchmarks.
First order benchmarks are typically related to access to ICT. This could be pupil: PC ratio and broadband access.

Second order benchmarks try to capture in what ways and to what extent ICT is used in teaching and learning. These benchmarks can cover a wide range of use patterns and learning technologies, and they should capture both teachers’ and students’ use of ICT for learning.

Third order benchmarks should cover the impact of ICT in teaching and learning. Benchmarks should be related to learning outcomes and learning strategies. Development of benchmarks should pay attention to the need for research and development in order to meet demands for validity and methodological rigor. Many countries have elaborated benchmarks of the first and second order, but it has proved difficult to develop solid third order benchmarks. Further research efforts should therefore be directed at the development of such benchmarks. Another important consideration regarding the benchmarking of ICT in education is related to the search for precision and validity. Given the complexity of education, underlying research-based concepts and models will inevitably reach a high level of sophistication. Herein lies a danger. The models can be too ambitious in their strive for perfection, and it is important to realise that the concepts and models behind benchmarks must find an equilibrium between simplicity and complexity, because, by the end of the day, they should meet the needs of policymakers and practitioners.

**Systemic challenges related to development of benchmarks**

The development of benchmarks does not happen in a vacuum; it serves purposes related to decision-making, informed choices and the need for a deeper understanding of ICT in education and its development. It is, however, difficult to know with great precision what we are looking for, because ICT is embedded in pedagogical practice. This is especially pertinent for the development of third order benchmarks. Another systemic challenge is related to the trend in recent years that education has evolved into an arena for solving many problems society as a whole and younger cohorts in particular are facing. The educational community may at times feel that it is under siege. Thus, development and utilisation of benchmarks that represent an administrative burden should be carried out with great caution. A particular advantage related to benchmarks is that they are well suited for international comparisons. However, so far little work has been done to develop an agreed international
framework for benchmarking ICT in education. It should be in everyone’s interest to develop an international benchmarking framework. This could be done in a joint OECD–EU collaboration. One important consideration is to agree on common topics for benchmarking, and it is in my opinion vital to make sure that a sufficient spectrum of issues is addressed. Digital learning resources are a good case for benchmarking development, because DLR has a high degree of complexity, they are important for the quality of learning and there is too little evidence on the impact of DLRs. Developing a framework for benchmarking is a challenge that cannot be solved by one party alone. It is vital to ensure that such a framework should be developed in a triangular collaboration between researchers, policymakers and practitioners. The notion of ‘methodological validity’ is important in research and benchmarking. When it comes to benchmarking of ICT and the issue of power of definition of what we are looking for to benchmark, it is in my opinion interesting to combine methodological validity with the notion of political validity. By political validity I mean (in the context of discussing benchmark development) that the choice of benchmarks should not only be directed by methodological perspectives, it should also pay attention to the needs of key stakeholders in education when it comes to the choices of benchmarks. As such, developing benchmarks should take place at the crossroads between policy, practice and research. Methodological validity ensures that we can trust the information we get from benchmarks, political validity ensures that stakeholders in politics and society get the information they need. Benchmarking can play a role in developing an open knowledge base for ICT in education. International collaboration is necessary for such a venture because of complex issues, a wide spectrum of stakeholders and the need for agreed frameworks for international comparisons. By the end of the day, the knowledge base should be there to guide us in informed choices for the benefit of current and future cohorts of learners.

*Within research on ICT and school development there is an increased understanding of the complexity involved in such processes. However, the focus on indicators and the impact of ICT in education from a policy perspective have been oriented towards a more narrow understanding of impact and outcomes, especially on the individual level. This article argues for the need for a multilevel approach towards ICT in education in order to fully understand the impact of such technologies in the education system. In the first part, some theoretical reflections on change and the research on impact are presented. In the second*
part, some examples will be described, mostly from a Norwegian setting, and in the last part, some key indicators of impact on different levels will be discussed (Erstad, 2013).

The challenge is not so much to develop indicators for ICT in education as such. At present there are several available frameworks of indicators, about implementation of ICT in educational settings, about digital literacy, about leadership and so forth. The challenge is rather to study different levels and domains at the same time, and to bring different sets of indicators together into one strategy in order to assess the broad scope of impact of ICT on education. In recent years, there has been a tendency to argue that complexity is an issue in itself in studying knowledge practices (Law and Mol, 2002) or studies on ICT, development and schools (Engestrøm, Engestrøm and Suntio, 2002; Thomson, 2007). In order to fully understand or assess the effects of ICT in education we need to know more about how ICT operates on different levels, and what we are really measuring on which levels. It is crucial that we synthesise the research with a holistic perspective in order to lay a foundation for further development in this area (Sutherland, Robertson and John, 2009). In this article, the argument is built around the need to look at the bigger picture in order to create sustainable developments throughout our education systems, and understand ICT as a catalyst for change on different levels. This creates challenges for the development of indicators of the impact of ICT in education since several sets of indicators need to be developed and different methods must be used. The objective would be to build a model that looks at how different levels and dimensions work together to create conditions for change and the integration of ICT in educational practice (Erstad, 2013). Monitoring can be defined very broadly as ‘the act of periodically/continuously observing something’. The act of observation will be called ‘assessment’ further on and hence regular assessment equals monitoring. An educational monitor is thus ‘assessment of education and how it is developing over time’. This definition is fairly neutral and could, in certain situations, when explicit targets are set, be translated into ‘assessment of education in order to determine if standards are met’. Educational monitoring can be focused on many different characteristics of education, such as input, processes and learning outcomes and many different methods can be used for collecting observations. Qualitative and quantitative methods can be distinguished. In this study, the main focus is on quantitative methods that allow for comparisons between countries and, hence, imply statistical generalizations to the educational system at large (Pelgrum, 2013).
infoDev maintains a series of knowledge maps that attempt to document what is known — and what is not known — about ICT use in education. These knowledge maps reveal that, despite a decade of large investment in ICT to benefit education in OECD countries, and increasing use of ICT in education in developing countries, important gaps remain in our knowledge. In addition, there appears to be a dearth of useful resources attempting to translate what is known to work and not work in this field for policymakers and donor staff working on education issues in developing countries, especially those issues related to "education for all" and other education-related millennium development goals. A lack of reliable data related to the impact of ICT on learning and achievement in developing countries, as well as a lack of useful indicators and methodologies to measure such impact, hampers policy guidance in this area. A mismatch also exists between methods used to measure the effects of ICT use in education in developing countries, and type of learning styles and practices that the introduction of ICT is meant to promote, or at least facilitate (Trucano, 2013).

Info Dev maintains a series of "knowledge maps' outlining what is known — and what is not — about the use of information and communication technologies (ICT) in education. These knowledge maps reveal that, despite a decade of heavy investment in ICT to benefit education in OECD countries, and increasing use of ICT in education in developing countries, significant gaps remain in our knowledge. In addition, there appears to be a dearth of useful resources for policymakers and donor staff working on education issues in developing countries, identifying what is known to work — and not to work — in this field, especially in support of "education for all" (EFA) and other education-related millennium development goals (MDGs) (see Trucano, 2005). The knowledge maps, which are used to help guide discussions between donors and governments exploring the use of ICT in the education sector, investigate 10 topics (impact of ICT on learning and achievement, monitoring and evaluation, equity issues, costs, current projects and practices, specific ICT tools, teaching and ICTs, content and curriculum, policy issues, and school-level issues). The key findings are divided into four major themes.

Key findings: Impact

- The impact of ICT use on learning outcomes is unclear, and open to much debate.
• Widely accepted, standard methodologies and indicators to assess the impact of ICT in education do not exist.

A disconnection is apparent between the rationales most often presented to advance the use of ICT in education (to introduce new teaching and learning practices and to foster 21st century thinking and learning skills') and their actual implementation (predominantly for use in computer literacy and dissemination of learning materials). The process of integrating ICT into educational systems and activities can be (and typically is) arbitrary, ad hoc and disjointed, as evidenced through recent infoDev surveys of ICT use in education in the 75 developing countries (Farrell et al., 2007a, 2007b, 2007c, Trucano, 2007). Such adhocracy often results in ineffective, unsustainable and wasteful investments. On the other hand, a comprehensive set of analytical, diagnostic and planning tools, such as those promoted through the ICT in education toolkit, can force a certain discipline on the process. The use of tools does not make policy formulation scientific' and rational'. Nor will it replace the political/organizational nature of policy formulation' (Haddad, 2007). That said, it is clear that current tools available to help aid policymakers make informed decisions about technology choices for schools are quite primitive. Reasonable minds can argue over what is meant by impact' and performance', but substituting belief for scientific inquiry does not seem to be a particularly responsible course of action. The power of ICT as an enabler of change — for good, as well as for bad — is undeniable. However, the use of ICT in education in many developing countries, especially the poorest of the poor', is associated with high cost and potential failure. Simply wishing away the existing local political economy of the way technology is implemented and supported in schools does not mean that it actually goes away. With more rigorous analysis and evidence of impact, and better decision tools, developing country policymakers — and their partners in the international community — can make wiser and more sustainable choices in deploying ICT to enhance access to, and quality of, education at all levels.

The integration of ICT in education is affecting educational systems in multiple ways. Likewise, ICT use in education influences the private life of all educational actors in the sense that these are engaged in innovative practices which require new methodologies, techniques and attitudes. Most studies carried out, however, do not provide clear information about multifaceted effects and impact of the learner and learning. There are still unanswered questions about the impact technology in the short and long terms learning and
how it has affected simple and complex learning tasks. turn, this important consequences in the articulation of educational policies. The identified gap in assessing the impacts of ICT is especially unsatisfying for policymaking stakeholders who aim at defining evidence-based strategies and regulatory measures for effective ICT implementation and efficient use of resources. Emerging technologies (e.g. smartboards, mobile devices) stimulate the change in contextual conditions for learning. Computer equipment and software are becoming increasingly available inside educational establishments as well as in private households — not only for school-related activities of young students, but also for learning at all stages in life. Instructional practices are changing due to new possibilities to access and share information, new roles and pedagogical paradigms. Furthermore, we observe new ways of learning in the context of new educational software applications and tools provided, digital resources available, etc. (see, for example, Redecker, 2009). This justifies once more the need to study the effects of ICT at different levels and to examine implications for the individual and society. More insights into the multifaceted effects are needed to enable us to conduct cost-benefit studies in an appropriate manner and to react to necessary changes by updating national curricula, designing teacher training programmes and revising adequate school and classroom implementation, keeping in mind that ICT is often a catalyst for change but does not itself determine the direction of change. There is a lack of comprehensive studies of the complex interactions between various types of ICT implementation and the effects of other factors such as school-based interventions, socioeconomic status and expenditure. It appears that, firstly, we are in need of instruments which will allow assessing and monitoring the state of use and changes affected. Secondly, we need to identify the various sources and gaps in a systematic manner in order to determine data available and desired. There are a number of ambitious initiatives to explore the scope of influencing factors already carried out (see, for example, Ramboll Management, 2006; Underwood et al., 2007). They provide a good basis for going one step further and designing a systematic approach to identify the use of ICT and its effects on all different levels and stages concerned. In many cases, in the context of school education, the massiveness of government top-down ICT-related programmes and reforms implied that policymakers were expecting schools to change sooner rather than later. Unlike books or blackboards, digital technologies tend to age and even become unusable within just a few years. Furthermore, technology changes very fast and even if older technology is still usable it can be incompatible with new digital products and services or be unsuitable for their full
exploitation. Overall, this top-down approach has had its own risks because the heavy investments could pay back only if schools were ‘ready enough’ to start immediately using ICT in productive ways. The massiveness of the programmes and reforms introduced also implied that the changes anticipated were envisaged to take place not just in some or even in the majority, but in all schools within a system. The reformers probably pushed ahead because they wanted to minimise the risk of creating inequalities among schools which make heavy use of ICT and those that, for one reason or another, do not. The scenario, however, that assumed that all schools would start using ICT in productive ways as soon as the teachers and the pupils put their hands on it was not very realistic. What was more plausible was that the top-down programmes and reforms would gradually help more and more teachers and pupils alter their teaching and learning practices. According to this scenario, the early adopters who used ICT prior to the implementation of massive top-down programmes and reforms will soon be joined by an early majority, and the sceptics, what Rogers (1995) called the ‘late majority’, will eventually follow them. In terms of thematic studies, there are a number of initiatives looking specifically into aspects of ICT in education. Empirica (2006), in a study financed by the European Commission, explores the access and use of ICT in European schools in 2006. It presents information for 25 EU Member States, Norway and Iceland, but it does not look into student results so it is not possible to study this important aspect of ICT impact. Another relevant study is SITES, which, like TIMSS, is under the auspices of the IEA. The survey explores the use of computers in teaching through sampling teachers, principals and ICT responsibility in schools. It does not look into student achievement, but it does look at the perceived impact on ICT in students from the teacher’s perspective.

The impact of ICT in education

Balanskat et al. (2006) reviewed several studies on the impact of ICT on schools in Europe. They conclude that the evidence is scarce and comparability is limited. Each study uses a different methodology and approach, and comparison between countries has to be done cautiously. Trucano (2005) also reviews a series of studies on ICT impact in schools. He also concludes that the impact of ICT use on learning outcomes is unclear and calls for the need for more ‘widely accepted methodologies and indicators to assess the impact on education’ (Trucano, 2005, p. 1). In a similar line, Cox and Marshall (2007) point out that
studies and indicators on ICT do not reflect sound effects. They maintain that this relates mainly to three aspects:

- Opposing views on ICT and education;
- Different perspectives on/goals for innovation in learning/learning contexts;
- Missing planning strategies for educational change.

**Student involvement**

One of the fundamental components of educational processes is student commitment. Although it may be obvious, the motivation and ongoing participation of students are necessary for project success. Furthermore, student motivation and enthusiasm in activities have a positive impact, not only with respect to potential learning results and development of new competencies but also to the learning environment, in stakeholder expectations and results for student promotion from one level to another. These processes also generate change regarding the motivation and expectations of parents and teachers. Both are intertwined with student motivation and expectations, resulting in the ongoing development of learning.

Data on attendance, repetition, promotion and drop-out rates are usually available and facilitate the performance of straightforward impact analysis. Measuring motivation requires other instruments which, when applied correctly, can yield important information about the effects of ICT4E projects. (16) „One of the fundamental lessons to be learnt from European, North American and Australian experiences over the last 20 years has been that those responsible for helping students learn must be confident in the appropriate use of new technologies if the process is to be successful. Introducing new technologies into places of learning should involve a fundamental shift whereby the role of teachers becomes less didactic and more that of facilitating individual learning processes.‘ (Unwin, 2005)

**Impact on Student achievement**

A country's education curriculum determines the knowledge and skills that students should achieve for each grade as well as tasks required of teachers and schools. The first area where impact is evident in ICT4E projects is in learning associated with a specific school subject or topic, or how the curriculum content is divided according to learning aims or expected
competencies for each student. Typically, this impact has been evaluated in subjects such as language, mathematics and science, since these are the subjects evaluated in most standardised tests (focus groups or by census) and, therefore, data are available in many countries (e.g. standardized tests such as TIMMS and PISA). Even though these instruments have had a small, limited field of measurement to date (limited to only certain skills and content), studies have revealed positive but moderate correlations between ICT projects and test results. There are some challenges in countries that do not have national tests or participate in international standardized tests. In these cases the project could develop ad-hoc standardized tests to be administered before, during and after the project implementation (baseline and evaluation) or among groups that do or do not participate in the project (control and comparison groups). This task is especially complex because the introduction of ICT into education processes is often accompanied by modifications in teaching methodologies. In fact, this is what is intended; with the introduction of ICT, old methodologies could have little or no impact. Evidently both students and governments reasonably expect that use of ICT in education (usually a complex and expensive process) will improve student learning, and this needs to be proven empirically.

Skills and competences

It is fairly common to point out that ICT use in education has an impact on the development of new skills and competencies in students. These competencies have often been described as ‘21st century skills’ due to their importance in a knowledge society age (17). There is extensive literature describing these competencies and it is therefore easy to consolidate a group of general competencies required by students that will eventually develop fully with the use of ICT. They have been grouped into three major areas: critical

(17) _To participate in this global economy and to improve their standard of living, students will need to leave school with a deeper understanding of school subjects, particularly science, mathematics and technology. They will need skills necessary to respond to an unbounded but uncertain 21st century to apply their knowledge to real-world situations, to think critically, to collaborate, to communicate, to solve problems, to create and continue to learn.‘ (Kozma, 2008) thinking and problem solving; creativity and innovation; and communication and collaboration. Development of ICT competences is also considered. Until now, evaluation has not been particularly exact and has been mostly conducted_
through qualitative studies, interviews and perception surveys that collect information/data on the vision of students, or through structured observation exercises. Nevertheless, more objective tools will be developed over time that will allow for more rigorous evaluation exercises.

One of the components of the OECD new millennium learners project is developing ICT competencies for a working definition framework and tools for evaluation. Another initiative working towards similar objectives is the alliance supported by CISCO, Intel and Microsoft and a group of universities and international institutions: _Transforming education: assessing and teaching 21st century skills_. Information and communications technologies are instruments that are a regular part of a range of work and development opportunities. Even a basic understanding of ICT use can result in opportunities for access and growth, both personally and professionally, which can make the difference in a country’s overall development.

ICT skills and competencies are a clear objective in any project involving the use of ICT in education; therefore it is necessary to evaluate the effectiveness of each project. To perform these tasks, standardised tests will be used alongside IDB’s own validated test to evaluate student ICT skills before, during and after implementation of activities in primary education.

**Development stages**

Clearly, the type of projects to develop and evaluate (as well as the impacts expected) will depend on the respective stage of development in the use of ICT in and the educational context where each project will be applied (18). The development stage reached through incorporation of ICT into education systems is strongly correlated with the type and depth of potential changes in application contexts. Thus, the intensity of use and the impact increase to the extent that efforts toward incorporation are sustained over time. Following Morel’s Matrix (2001), four project phases are proposed which are vital in the project’s design, implementation, follow-up and evaluation steps, and in the follow-up of comparable education systems. Therefore, by analysing the indicators described in the _Processes and products_' column, you can determine the development (18) _Countries which are presented in the initial stages of ICT incorporation in education have different assessment needs than those who already have a long tradition of use. For example, initially it is important that teachers and students have access to software and hardware and that they have acquired
basic skills in computer science. Countries which are at the initial stages of ICT incorporation in education have different assessment needs than those who already have a long tradition of ICT use. For example, initially it is important that teachers and students have access to software and hardware and that they have acquired basic skills in computer science. In the case of countries at more advanced stages, other considerations such as management of educational innovations, changes in educational curricula and other organizational changes in schools, and ongoing support and training for staff are more important. (Manual for the production of statistics on the information economy, UNCTAD, 2008) stage of the project (emerging, applying, integrating and transforming) and inform the expected outcome with results indicators.

For example, you can generically describe these steps for each domain considered in the general framework, in the table. The table operates in practice as a section for reading the indicators present in a system or project, which allows for ascertaining maturity or stage of development.

**Domains or inputs**

**Domains or** inputs considered in project design and evaluation include the following:

1. **Infrastructure**

   a. **Physical**: Initiatives associated with provision of infrastructure necessary for the use of and access to ICT, e.g. laboratories, libraries and furniture.

   b. **Equipment**: Equipment planned for the project or considered part of the project (even if not conceived as a direct part of the project) includes computers, printers, projectors and the conditions included in the purchase and use of those items, e.g. guarantee and service support.

   c. **Connectivity**: Access to Internet and networks that allow their use for education purposes; bandwidth access, connection stability and technologies that facilitate better online traffic and provide privacy protection filters for content accessed by students. Implementation of a reliable local network structure that is safe and accessible.
d. Support: Activities aimed at administration, maintenance and repair of equipment as well as problem-solving related to project activities and technical support for users.

2. Contents

a. ICT curriculum: Initiatives linked to the implementation and/or adaptation of curriculum content in ICT or other subjects (in the use of ICT).

b. Content: Digital or analog material aimed at teaching and learning with technology tools, e.g. encyclopedias, manuals, textbooks, books, guides, videos and hypertext.

c. Tools: Software development or support initiatives for development of teaching and learning processes; e.g. productivity applications, virtual simulators and modeling.

d. Information systems: Aimed at supporting implementation and distribution of management and education information systems at the school, country and regional levels, as well as those that allow monitoring of educational projects and their stakeholders, including curriculum, pedagogies and possible models of use.

3. Human resources

a. Teacher training: Initial and in service training associated with the adoption, adaptation and updating of curriculum and practices for the integration of ICT into education.

b. ICT competences: Training activities for the acquisition and/or certification of specific ICT skills, general education, and productivity and communication tools.

c. Use of ICT for education:

   Training initiatives for the specific use of ICT in educational contexts (20).

d. Pedagogical support: Efforts to provide educational support and follow up for participants, guidance or tutoring service developed for implementation of proposed activities.
4. Management

a. Administration: Structures and strategies for system and project management and administration for all levels considered (school, province, country and region) as well as the relationship with other institutional stakeholders associated with the project e.g. strategic allies and donors.

b. Information dissemination:

Activities aimed at providing information about project results, strategies and actions and involving all potential interested stakeholders and beneficiaries of the project.

c. Community involvement: How scope, strategies and actions are communicated. How all actors concerned and potentially affected by the project’s development are involved.

Actions that promote (and allow for) the active participation of community members and families in the development (and as direct beneficiaries) of the project.

5. Policy

a. Planning: The project's priority (short or long term) in the context of other initiatives, plans, projects or actions, including visibility (under- (20) Particularly important here is Unesco’s work in the development of the use of ICT in education and its standards for teachers. stood as the ownership level with the success and objectives of those leading the project).

b. Budget: Long-term budget needed for operational continuity and development of complementary initiatives required for the project’s success.

c. Legal framework: Actions to adjust and adapt the rules and regulations to enhance and improve the impact of the initiative and minimize the risks. Includes measures to improve the safety and security of minors, regulations associated with industries and copyright protection

d. Incentives: Plans and programmers designed to (positively or negatively) underscore beneficiary commitment and the results of the project expected by its participants.
5. Processes and products

Processes and products being proposed to allow the framework to support the design, implementation and monitoring of specific projects developed to incorporate the use of ICTs for educational purposes.

For example, listed below are some of the products and processes that may typically be considered as part of these projects and whose observation and monitoring will reveal how each contributes to achieving the expected results.

1. Infrastructure

a. Amenities: Specific references about the technical characteristics of the equipment. The relationship between product characteristics and specific reasons why the equipment was selected; distribution and the final characteristics of the equipment as it is implemented. Also included here is the connection with other existing equipment indirectly related to the success of the project. Characteristics and conditions of connectivity.

b. Implementation process: Description of project logistics, location and equipment distribution. Additionally, specifics on the procedure for equipment selection, purchasing, distribution and integration/implementation in projects. Also included are references to the investment made in the context of the project essential to its success, such as classrooms or buildings (even when they have not been a project specific component), as well as calendars and systems in use by ICT users and their availability.

c. Helpdesk: Describes systems installed to lend support to indirect and direct project beneficiaries in the event of technical and pedagogical difficulties. It will provide the user rate, response time, mechanism used, most common difficulties, the best rated responses and other indicators describing support available to participants.

2. Resources

a. Curriculum development: Work developed to connect curriculum to the learning goals and project objectives associated with ICT4E. Inclusion of ICT in the curriculum at the different levels as a competency or as cross-cutting or vertical content, learning goals specifically proposed by the stakeholders.
b. **Learning organisation:** Description of how learning activities are structured and organised, including how the curriculum is developed (integrated or separated from other thematic areas), how often and at what time of day ICT is integrated into the curriculum, pedagogical approach(es) at the institutional level as well as knowledge management strategies.

c. **Availability of resources:** Levels of access to educational resources from direct and indirect beneficiaries; whenever possible underscore relevance and importance with respect to project objectives.

d. **Access and use:** The opportunity for and simplicity of access to the information and management systems by the beneficiaries (direct or indirect), whenever possible, provide their relevance to and the quality of the proposed objectives.

3. **Human resources**

   a. **Teacher performance:** Describes teacher background information pertinent to the project: e.g., performance, planning activities, student:teacher ratio, performance evaluation and incentives.

   b. **ICT experience:** Previous experience with ICT in educational use, both in and outside the classroom.

   c. **Models for educational use:**

   Characteristics of ICT training to stakeholders in order to capitalise on the use of ICT in educational contexts.

   d. **Education support system:** Mechanisms aimed at motivating and lending support to the work of different stakeholders involved in the project, such as tutoring or assistantships for teachers, personal or online support plans, training resources, mutual communication among peers and guides for families.
4. Management

a. **School organization**: The way the project is integrated into the overall institutional scheme of the school, how many hours each teacher spends on it and systems aimed at organising and supervising the project’s operation.

b. **Management systems**: Institutional framework, systems and mechanisms implemented by the project, or that the project modifies and impacts and which allow for follow-up of project activities and objectives.

c. **Systems use**: Opportunity for and simplicity of access to the information and management systems by the beneficiaries (direct or indirect), whenever possible stating relevance to and quality of the proposed objectives.

d. **Community attitudes and expectations**: Actions involved in the project’s implementation aiming to include the initiative in its development context, introduction of participants (direct or indirect) to the project, communication with those involved in the project who facilitate the project’s implementation. Also describe how the project considers the impact on the community, particularly regarding students’ families.

5. Sustainability

a. **National (sub national) plans**: Displays the existence or lack of national plans that comprehensively maintain and describe the use of ICT in education systems, linking them to each other and to the rest of the goals and policies, and to the development strategies as well.

b. **Budget**: Different budget sources and procedures that are directly or indirectly involved in the project’s operations. Any difficulties with the procedure and future financing plans should be described. The expenses entailed by the project should be noted, specifying one-time purchases as well as recurring purchases that will therefore be part of the project in the future. Mechanisms recommended to secure funding in the future. For long-term implementation, the project’s strengths and weaknesses and how the project itself plans to address them. This will include the total ownership cost as proposed by GESCI (21).
c. **Priority and visibility:** The position of those responsible for the project as well as project objectives and the promotion of such activities.

d. **Legal framework:** Description of regulations associated with project implementation.

e. **Incentives plans:** Programmed or incentive plans associated with the project's beneficiaries and objectives. The Conceptual Framework is not proposed as an evaluation model, nor does it develop specific assessment instruments. It should work as a guide to consider the elements involved in ICT for education projects. The evaluators using the Conceptual Framework should then apply and develop the adequate evaluation models and instruments depending on the context.

1. **Baseline**

The data that inform the processes and products before the project’s implementation and by which the project impact can be measured. The baseline is concerned with data that allow for identification of indicator status at the system level upon starting the application or before project implementation. From these initial data (sum zero), system progress or project action impact will be measured, once they are implemented. The baseline should take into consideration the systems level, a broad set of indicators that facilitates precise analysis of ICT incorporation status. At the project level, you should select those indicators that explicitly impact the project's objectives, including those linked to student learning. Wherever possible, however, the data for all processes should be taken into consideration to facilitate documentation of unforeseen impacts.

2. **Follow-up and monitoring**

When applied at the system level, steady action is required that may be implemented to ascertain changes occurring due to various actions aimed at incorporating ICT into education systems. Periodic application (annual, biannual or as frequently as possible) aims to shed light on the decision making of policymakers. At the project level, relevant data design in the intermediate steps of the project’s implementation will inform progress and steer the project toward its proposed objectives, allowing for early problem detection and correction in learning. Technically precise periods (e.g. monthly, quarterly, biannually) may be formally set for development of the monitoring phase, according to specific project
characteristics, but technological models may also be established enabling permanent feedback to project administrators in the form of pertinent information for monitoring and decision-making.

3. Evaluation

This process involves comprehensive review of a project, its achievements, progress and difficulties, and establishes its impact vis-à-vis proposed objectives. Evaluation is conducted at project completion or at the end of a given phase of the project’s implementation, and its purpose is to measure actions and the strategy proposed against the results obtained, and to monitor its relationship with and impact on system indicators. Along these lines, impact made on all areas, processes and products must be taken into consideration and not only the ones where the project has implemented actions. Evaluation is a process that is crucial to every project and should be considered an essential component at the outset of project design. Whenever possible, efforts should be made to have evaluation conducted by an external entity unassociated with the project’s direct or indirect executors, to achieve objectivity and impartiality. Whenever possible, experimental evaluation methods should be favoured to complement other data sources to produce more solid, reliable results.

3. Indicators for ICT in education

Application of the conceptual framework on a set of indicators is proposed as an exercise to facilitate a comprehensive view at the system level (sub national, national, regional or global) and at the project level as well.

Regarding use in monitoring systems, we propose creating an index based on a set of indicators to help describe the respective system. When applying indicators at the project level, this set of indicators lends support to and organizes the project evaluation process, but in no case is it completely exhaustive, since this process involves many other variables. For purposes of organizing the indicators and associating them to the proposal framework, we have considered the need for input, process and impact indicators, depending on the data type you want to describe and its scope of application. Nonetheless, process indicators are applied exclusively at the project level and refer specifically to the components that each project proposes to develop; consequently, it is defined ad hoc (Bilbao-Osorio and Pedró, 2013).
Information and communication technologies (ICT) have become commonplace entities in all aspects of life. Across the past twenty years the use of ICT has fundamentally changed the practices and procedures of nearly all forms of endeavor within business and governance. Within education, ICT has begun to have a presence but the impact has not been as extensive as in other fields. Education is a very socially oriented activity and quality education has traditionally been associated with strong teachers having high degrees of personal contact with learners. The use of ICT in education lends itself to more student-centered learning settings and often this creates some tensions for some teachers and students. But with the world moving rapidly into digital media and information, the role of ICT in education is becoming more and more important and this importance will continue to grow and develop in the 21st century. This paper highlights the various impacts of ICT on contemporary teacher training institutions of education and explores potential future developments. The paper argues the role of ICT in transforming teaching and learning and seeks to explore the awareness of teacher educators about use of information and communication technology for effective teaching learning process and how this will impact on the way programs will be offered and delivered in the teacher training institutions (Mathur and Madhu, 2012).

2.3 FRAMEWORK OF LEARNING S OF ICT

The purpose of this paper aims to bring together the findings and key points from a review of significant part of the available literature associated with ICTs for Education and ICTs in Education. This review set out to identify and evaluate relevant strategies in national and international research and initiatives related to measuring and demonstrating the effective use of ICT for education with regard to the teaching learning process; ICT and quality and accessibility of education; ICT and learning motivation, ICT and learning environment, and ICT to enhance the scholastic performance.

Information and communication technologies (ICT) have become commonplace entities in all aspects of life. Across the past twenty years the use of ICT has fundamentally changed the practices and procedures of nearly all forms of endeavour within business and governance. Education is a very socially oriented activity and quality education has traditionally been associated with strong teachers having high degrees of personal contact with learners. Information communication technologies (ICT) at present are influencing
every aspect of human life. They are playing salient roles in learning places, business, education, and entertainment. Moreover, many students recognize ICTs as catalysts for change; change in learning conditions, handling and exchanging information, teaching methods, learning approaches, scientific research, and in accessing information.

The use of ICT in education lends itself to more student-centred learning settings. But with the world moving rapidly into digital media and information, the role of ICT in education is becoming more and more important and this importance will continue to grow and develop in the 21st century. In this paper, a literature review regarding the use of ICTs in education was provided. Effective use of ICT for education, along with ICT use in the teaching learning process; quality and accessibility of education; learning motivation. Learning environment, and ICT and scholastic performance are important factors.

Education is one of the main keys to economic development and improvements in human welfare. As global economic competition grows sharper, education becomes an important source of competitive advantage, closely linked to economic growth, and a way for countries to attract jobs and investment. In addition, education appears to be one of the key determinants of lifetime earnings. Countries therefore frequently see raising educational attainment as a way of tackling poverty and deprivation.

In developing countries, education is also linked to a whole batch of indicators of human development.

Education of women influences the health of children and family size. The experience of Asian economies in particular in the past two decades has demonstrated the benefits that public investment in education can bring. In richer countries, education is seen as important not just in the early years, but also in later life. As the pace of technological change quickens and as the learning force in many rich countries grows older, education offers a way to improve and update the skills and capabilities of the learning force.

There are, however, many constraints on delivering education to the right students at the right time. In developing countries, there is frequently a shortage of qualified college teachers. Students may live in scattered communities in rural areas. Money for books and teaching materials may be scarce. In wealthier countries, money is also a problem: in particular, the cost of university education has risen sharply, and students are increasingly
expected to meet all or part of the cost directly. But, at the level of higher education and training, the problem is often also one of time. Students who are already in full-time employment find it hard to take part in a university course offered at conventional times of day. Finally, employers, keen to train staff, are often acutely conscious of the costs of taking students away from their main job in order to attend training courses. They are therefore eager for more efficient and flexible ways to deliver information to students.

All these factors have encouraged an interest in the use of information and communications technologies (ICT) to deliver education and training. Computers began to appear in college and university classrooms in the more advanced countries around the early 1980s. Broadband connections to institutes and universities became commonplace in wealthier countries in the second half of the 1990s. In developing countries, experience is more limited. This is not necessarily a bad thing, as it should allow those countries to learn from the investments of richer countries. Initially, educators saw the use of ICTs in the classroom mainly as a way to teach computer literacy. Most now see a broader role: that of delivering many kinds of learning at lower cost and with higher quality than traditional methods of teaching allow. In addition, institutes and universities increasingly use ICTs, as do other large organizations, to reduce the costs and improve the efficiency of administration.

By far the largest investments so far in ICTs have been in the United States. The United States’ budget for the use of technology in institutes is enormous: since 1989, the US Department of Education has invested almost US$1 billion in the use of technology in public education.

Not surprisingly, most of the learning developing educational ICTs and their most widespread applications are in the United States. And, as a result, many of the evaluations of ICTs have been carried out in the United States. Some lessons from American experience will be universal. Others will be peculiar to that country’s education system, which at the higher level involves more private money and enterprise than does higher education in most other countries.

In examining the development of ICTs in institutes, universities and training, an important distinction should be made. In the case of institutes, teachers primarily use ICTs in the college as an instructional device. —Distance learning is rarely part of college teaching. In the case of higher education and training, students are more likely to use ICTs partly to learn
at a distance from the instructor. Different teaching techniques are thus probably required in the two areas of education. Also important to remember is the fact that most investment in education is publicly financed. Indeed, some has been driven more by politics than education policy. Computers and broadband connections have a high level of visibility; that makes them an attractive way for politicians to claim to be upgrading education with public money.

2.4 SUPPORTIVE FACTORS FOR ICT

ICTs are making dynamic changes in society. They are influencing all aspects of life. The influences are felt more and more at institutes. Because ICTs provide both students and teachers with more opportunities in adapting learning and teaching to individual needs, society is, forcing institutes aptly respond to this technical education.

Tinio (2002), states the potentials of ICTs in increasing access and improving relevance and quality of education in developing countries. Tinio further states the potentials of ICT as follows:

ICTs greatly facilitate the acquisition and absorption of knowledge, offering developing countries unprecedented opportunities to enhance educational systems, improve policy formulation and execution, and widen the range of opportunities for business and the poor. One of the greatest hardships endured by the poor, and by many others, who live in the poorest countries, in their sense of isolation, and ICTs can open access to knowledge in ways unimaginable not long ago.

Pelgrum and Law (2003) state that near the end of the 1980s, the term _computers’_ was replaced by _IT’ (information technology) signifying a shift of focus from computing technology to the capacity to store and retrieve information. This was followed by the introduction of the term _ICT’ (information and communication technology) around 1992, when e-mail started to become available to the general public (Pelgrum, W.J., Law, N., 2003).

According to UNESCO (2002), information and communication technology (ICT) may be regarded as the combination of _Informatics technology_ with other related technology, specifically communication technology. 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.

In Watson's (2001) description, ICTs have revolutionized the way students learning today and are now transforming education systems. As a result, if institutes train children in yesterday's skills and technologies they may not be effective and fit in tomorrow’s world. This is a sufficient reason for ICTs to win global recognition and attention. For instance, ICTs are dependable tools in facilitating the attainment of one of the Millennium Development Goals (MDGs), which is achievement of universal primary education by the year 2015.

Kofi Anan, the former United Nations Secretary General, points out that in order to attain the goal of Universal Primary Education by the year 2015; we must ensure that information and communication technologies (ICTs) unlock the door of education systems. This indicates the growing demand and increasingly important place that (ICTs) could receive in education. Since ICTs provide greater opportunity for students and teachers to adjust learning and teaching to individual needs, society is, forcing institutes to give appropriate response to this technical education.

Even though ICTs play significant roles in representing equalization strategy for developing countries, the reality of the digital divide- the gap between those who have access to, and control technology and those who do not, make a huge difference

2.4.1 ICT enhancing teaching and learning process

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 college experience to learning practices, create economic viability for tomorrow's learning ers, as well as strengthening teaching and helping institutes change (Davis and Tearle, 1999; Lemke and Coughlin, 1998; cited by Yusuf, 2005). In a rapidly changing world, basic education is essential for an
individual be able to access and apply information. Such ability must find include ICTs in the global village.

Conventional teaching has emphasized content. For many years course have been written around textbooks. Teachers have taught through lectures and presentations interspersed with tutorials and learning activities designed to consolidate and rehearse the content. Contemporary settings are now favouring curricula that promote competency and performance. Curricula are starting to emphasize capabilities and to be concerned more with how the information will be used than with what the information is.

Contemporary ICTs are able to provide strong support for all these requirements and there are now many outstanding examples of world class settings for competency and performance-based curricula that make sound use of the affordances of these technologies (Oliver, 2000).

According to Cabero (2001), "the flexibilization time-space accounted for by the integration of ICT into teaching and learning processes contributes to increase the interaction and reception of information. Such possibilities suggest changes in the communication models and the teaching and learning methods used by teachers, giving way to new scenarios which favour both individual and collaborative learning‖. The use of ICT in educational settings, by itself acts as a catalyst for change in this domain. ICTs by their very nature are tools that encourage and support independent learning. Students using ICTs for learning purposes become immersed in the process of learning and as more and more students use computers as information sources and cognitive tools (Reeves & Jonassen, 1996), the influence of the technology on supporting how students learn will continue to increase.

2.4.2 ICT enhancing the quality and accessibility of education

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 improve the quality of learning. In concert with geographical flexibility, technology-facilitated educational programs also remove many of the temporal constraints that face learners with special needs (Moore & Kearsley, 1996).
Students are starting to appreciate the capability to undertake education anywhere, anytime and anyplace. One of the most vital contributions of ICT in the field of education is Easy Access to Learning. With the help of ICT, students can now browse through e-books, sample examination papers, previous year papers etc. and can also have an easy access to resource persons, mentors, experts, researchers, professionals, and peers—all over the world. This flexibility has heightened the availability of just-in-time learning and provided learning opportunities for many more learners who previously were constrained by other commitments (Young, 2002). 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. As well as learning at anytime, teachers are also finding the capabilities of teaching at any time to be opportunistic and able to be used to advantage. Mobile technologies and seamless communications technologies support 24x7 teaching and learning. Choosing how much time will be used within the 24x7 envelope and what periods of time are challenges that will face the educators of the future (Young, 2002).

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.

2.4.3 ICT enhancing learning Environment

ICT presents an entirely new learning environment for students, thus requiring a different skill set to be successful. Critical thinking, research, and evaluation skills are growing in importance as students have increasing volumes of information from a variety of sources to sort through (New Media Consortium, 2007). ICT is changing processes of teaching and learning by adding elements of vitality to learning environments including virtual environments for the purpose. ICT is a potentially powerful tool for offering educational opportunities. It is difficult and maybe even impossible to imagine future learning environments that are not supported, in one way or another, by Information and Communication Technologies (ICT).

ICT provides opportunities to access an abundance of information using multiple information resources and viewing information from multiple perspectives, thus fostering the authenticity of learning environments. ICT may also make complex processes easier to
understand through simulations that, again, contribute to authentic learning environments. Thus, ICT may function as a facilitator of active learning and higher-order thinking (Alexander, 1999; Jonassen, 1999). The use of ICT may foster co-operative learning and reflection about the content (Susman, 1998). Furthermore, ICT may serve as a tool to curriculum differentiation, providing opportunities for adapting the learning content and tasks to the needs and capabilities of each individual pupil and by providing tailored feedback (Mooij, 1999; Smeets & Mooij, 2001).

2.4.4 Intelligence Generation by students through ICT

Intelligence generation has inertial tendency in education in education. Intelligence generation has been conceptualized as a dialectical process, in which various contradictions are synthesized through dynamic interactions among individuals, the institutes, and the environment (Nonaka and Toyama, 2002). Wiig (1997) defined intelligence generation as understanding, focusing and managing systematic, explicit and deliberate intelligence building, renewal and application. The use of intelligence generation to gain performance advantage has also been emphasized. The term —intellectual capital encompasses all forms of student intelligence that can be converted into profit, including know-how and processes, patents and copyrights, as well as the skills and experience of students and relationships with students and suppliers. The resource-based view of the institute has led to an increasing interest in the idea that intelligence is a key resource that institutes must proactively manage if they are to sustain competitive advantage over the long haul. Theory of intelligence-generating institutes provides for institutes to propose that intelligence generation is critical for CE (Nonaka and Takeuchi, 1995). Further, he also addressed the question of how institutes organize the process of intelligence generation and dissemination and use it to design new products, services or systems (Barringer and Bluedorn, 1999; Covin, 1991). Moreover, learning institutes tend to engage in greater level of information-scanning activities (Hambrick, 1982; Narver and Slater, 1990; Jawaroski and Kohli, 1993; Barret and Weinstein, 1998; Nonaka and Toyama, 2002; Ramachandran and Ray, 2006).

Maintaining good communication with external constituents, especially students, facilitates the flow of information and other resources that are crucial for education (Barringer and Bluedorn, 1999; Fiol, 1996; Hornsby et al., 1993; Kanter, 1982; Lumpkin and Dess, 1996; von Hipple, 1978; Zahra, 1991). Christensen (1997) and Utterback (1994) pointed to the
danger of allowing student to dictate education. Given an insight into the deficiencies of intelligence processes and their causes, it becomes possible to analyze whether changes in the structure, the information and communication technology or the human resource management of the institutes are needed to resolve them.

2.4.4 Intelligence Dissemination, Knowledge Sharing and ICT

Institutes act on the basis of their market intelligence including their intelligence of students and competitors. The concepts of intelligence dissemination have also been emphasized for CE outcomes. Appropriate infrastructure and processes are the instruments for improving intelligence dissemination (Ruggles, 1996) (i.e., selecting, training and motivating students to share intelligence) and institutional measures (i.e., self-regulating teams to enhance dissemination intelligence).

It has been found that person’s interactions result in greater trust, self-disclosure, and commitment between them (Frances and Sandberg, 2000), which increases the mutual predictability of team members’ actions and increases mutual trust using ICT. Familiarity with one another fosters a safe environment facilitating the generation of alternative views leading to more effective decision-making processes (Nonaka and Takeuchi, 1995; Sheshadri et al., 2003).

Education is a key differentiator at all levels. Just as it can change the complete worldview and lifestyle at the level of an individual, at an aggregate level of a community, state or country, it can determine both the direction and rate of economic development. Effective teaching, therefore, has always been considered a sine qua non of good societal— and within a society good human development. In this article we analyze what determines the extent and nature of use of information and communication technologies (ICT) in classroom teaching of management subjects and also how the use of ICT can impact the effectiveness of classroom teaching of management. The abbreviation ICT is used in this article as an umbrella term that includes any single information or communication technology, a combination of many of these or any technology based on the convergence of these.

Because of its importance, education has been a subject of intense research among academics from various disciplines. Buffa and Sarin (1987) present a four-category modified version of the classification scheme of Baumol (1984) in which he categorized
education as a stagnant personal service—the category having the least potential of productivity enhancement and cost reduction through use of technology. In fact, the next category of substitutable personal services can have a great leap in productivity through technological education but while the substitutes for the personal services are less costly, they are often also inferior. The remaining two categories, namely progressive services and explosive services, both have a huge potential of productivity enhancement through technological education, although the overall effects are quite different for each. Later, Baumol (1995) defended the case for subsidizing such public goods as education and arts—else not enough quantity will be produced in the economy. His comments were obviously restricted to the classroom teaching mode and it therefore appears that technology may have a role in improving the effectiveness of classroom teaching and not so much its efficiency.

At another level, the purpose, pedagogy and performance of education at primary, secondary and tertiary levels are quite different from each other thus suggesting that the use of technology in general or that of ICT in particular should also be different. According to Punie et al. (2006) the use of ICT for learning is most widespread in the tertiary education. Even within tertiary education, the use and role of technology in higher education and in professional education are quite different. Finally, as a category of professional education, management education has been influenced by technology both as a driver and as an enabler.

ICT has had a major role in the delivery of educational programmes at the tertiary level—particularly in management education. In fact, this phenomenon has been referred to as technology mediated learning (TML) in the literature (Alavi and Gallupe, 2003). Technology drives the complete delivery of education in these applications. However, in this article we focus on the use of technology in classroom teaching, i.e., using the conventional delivery mode.

Thus, we study the use of technology as an enabler and not as a driver of the teaching/learning processes. Evans (2001) differentiates between traditional classroom education and technology-enhanced classroom education. Traditional Classroom Education involves regular class meetings and face-to-face faculty lectures with limited use of technology (such as transparencies). In Technology- Enhanced Classroom Education, the dominant mode of learning remains regular class meetings and face-to-face faculty lectures.
However, technology plays a significant role inside and outside the classroom (via PowerPoint slide presentations and computer-related faculty presentations, computer simulations, e-mail, chat groups, bulletin boards, CD-ROMs, online learning materials at faculty Web pages, etc.). (Evans, 2001, p. 2) One can perhaps add DVDs, streaming videos, blackboard discussion boards, and other learning management system based ones to this list today. Cohen (1997) observed that as compared to traditional ones, technology-rich classrooms offered more fluid social interactions between teachers and students, and learning was seen as a more natural process. Of course, his observations were made on a small sample of secondary college students. Landen (1997) questions whether technology is suitable for all types of students or for all types of learning and cautions that educators need to be knowledgeable and selective in their use of technology. Some other authors have also cautioned against the overuse, under-use and misuse of ICT, while at the same time giving a very clear message that ICT has provided us a great opportunity that has to be harnessed (UNESCO, 2002).

An international comparative survey conducted in six European countries and in USA on the use of ICT in higher education (Collis and van der Wende, 2002) found that higher education institutions neither expect nor are adopting radical change related to the use of ICT. Although use of ICT is widespread in the campus as part of the teaching and learning process, the lecture remains the most valued instructional form. In the absence of a clear institutional policy or any systemic reward or punishment for ICT use, actual use depends on the instructors’ views on teaching and learning and on their actual learning load and job satisfaction.

A similar picture was presented by Stottinger and Schlegelmilch (2002) when they studied a sample of 221 Austrian students and found that while the students had a positive attitude towards the use of ICT, institutions in tertiary education were only reluctantly using ICT and its intensive use was rather limited. In another survey, Nooriafshar (2005) found that visually enriched learning environments were considered very effective by students and he suggests that this idea can be used in globalizing education by creating learning environments with a lower text dependency to suit students whose native language is different from the medium of instruction. A review of studies of ICT impact on institutes in Europe (Balanskat et al., 2006) found that all the studies reviewed had identified a range of
important wider benefits of ICT on learning, including the positive impact of ICT on students’ motivation and skills, independent learning and teamlearning.

2.5 VARIABLES IDENTIFIED FROM LITERATURE SURVEY

The institute level ICT issues having dominant influence on ICT outcomes as supported by multiple research evidences from the literature have been identified for empirical investigation under the study. Variables having similarity of concepts, or those contributing to the same result(s), have been grouped together in terms of macro variables. These antecedents are listed below:

*ICT enhancing teaching and learning process*

Measured by potential to accelerate, enrich, and deepen skills, to motivate and engage students, to help relate college experience to learning practices, create economic viability for tomorrow's learners, as well as strengthening teaching and helping institutes change (Davis and Tearle, 1999; Lemke and Coughlin, 1998; cited by Yusuf, 2005).

*ICT enhancing the quality and accessibility of education*

Measured by increase in 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 and seamless communications technologies support 24x7 teaching and learning (Moore & Kearsley, 1996).

*ICT enhancing learning Environment*

Measured in terms of enhancing critical thinking, research, and evaluation skills are growing in importance as students have increasing volumes of information from a variety of sources (New Media Consortium, 2007).

*Provides Learning Discretion* to students and faculty

Measured by (i) freedom to develop ideas, (ii) own boss, (iii) autonomy of learning methods, (iv) autonomy of judgment, (v) autonomy of abilities, (vi) autonomy in selection
of business ideas, (vii) autonomy of decision-making and (viii) autonomy of job (Hornsby et al. 2002).

*Provides Flexibility to students to learn at their ease*

Measured by (i) learning performance (in terms of time, amount, quality, and timeliness), (ii) clarity of standards of performance, (iii) absence of standard operating procedures, (iv) written rules and procedures and (v) administrative processes (Burgelman and Sayles, 1986).

Intelligence Generation by students through ICT

Measured by (i) good communication, (ii) polling end users, (iii) intelligence generated independently (by different departments), (iv) periodical review, (v) collection of macroeconomic information, (vi) maintaining contacts (with regulatory bodies), (vii) evaluating information on social trends, (viii) spending time with suppliers and (ix) few students collecting information (Jawaroski and Kohli, 1993; Nonaka and Toyama, 2002).

*Intelligence Dissemination* by students through ICT

Measured by (i) spending time discussing student needs, (ii) periodical study material circulation, (iii) cross functional meetings, (iv) inter-departmental meetings, (v) spending time sharing information about technology and (vi) information spreading at all levels (Nonaka and Toyama, 2002; Jawaroski and Kohli, 1993).

*Time Availability through ICT*

Measured by (i) not too heavy learning load (design of learning methods), (ii) plenty of time, (iii) right amount of time and learning load, (iv) little time to think about wider institutional problems, (v) learning ing with time constraints and (vi) time for long-term problem solving (Slevin and Covin, 1997).

2.6 **CONCLUDING REMARKS**

The review of literature suggests that the recent trend in ICT is towards the management of students’ activities. Numbers of traditional concepts are fast changing to make place for new concepts accepting the need to address the requirements of fast changing global markets.
Apparently, the new trend indicates towards adoption of ICT for successful product, service, market and process development.

The changes in the market environment are affecting both advanced countries and developing countries. The net result of the changes can be summed up as: rapidly advancing technology, globalization of business, rising competition, rising number of new competitors, shrinking product life-cycle, world-wide sourcing, new products being introduced at faster pace than before, students expecting higher quality products and services at lower prices, market saturation leading to search for newer markets and implementation of better and more efficient processes for meeting better students requirements.

Flexibility in institutes has now acquired a newfound important status in ICT. A closer look on published literature indicates that organisational flexible boundary as a separate stand-alone strategy is rapidly changing. The supportive environment including the design of rewards and HR practices has already acquired a level of flexibility in actual institutes through the implementation of ICT. Inter-departmental collaboration in developmental activities can also be enhanced through ICT. HR practices/policies particularly related to management support, learning discretion emerging out of specially designed structure, time availability, interdepartmental collaboration for knowledge sharing and risk-taking have important role in creating implementing environment for better education facilities for the students. Without the supporting environmental drivers, implementing ICT becomes an oxymoron.

Management support has very significant influence on the ICT outcomes. The research evidences from the literature suggest that success in the ICT process is largely the consequence of three levels of strategies. The first level strategies relate to the institute level decision including joint ventures, acquisitions, mergers, vision and organisational objectives and goals. The second level includes departmental level strategies such as management support and flexible boundary. The third level of strategies relate to the functional level strategies for students including intelligence generation and dissemination, rewards, learning discretion and time availability for pursuing education.