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Exploring the extent of ICT in supporting pedagogical practices in Developing Countries

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Abstract:

Despite the improvements in the access to and use of ICT around the world, there is evidence which suggest that a persistent digital divide between and within countries. Nowhere is the ICT gap more evident than in the education sector. The main stakeholders (i.e. students and educators) in developing countries often lack access to computers and software, and educators are not always trained in how technology can aid learning.

Furthermore there is a huge debate about the role and extent of the information and communication technology (ICT) in transforming the pedagogical practices – especially in developing countries like Ethiopia.

Despite the fact that ICT related infrastructure in most developing nations are limited, it has been claimed that ICT based technologies has the capacity to transform the provision of all higher education globally. In order to investigate such claims, in this paper, we review the existing literature with the aim of to carry out further an ethnographic based research at the Addis Ababa University (AAU) which is one of the oldest tertiary level education institutes in Africa with current enrolment of over 40,000 students in its regular and continuing education programs and at Unity University which is the first privately owned institute of higher learning in Ethiopia with current enrolment of over 7,000 students.

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The main focus behind our research interest is to identify the role and extent of ICT in pedagogical practices. Furthermore as most of the studies reviewed so far seem to focus on intuition or anecdotal evidence, in this research I plan to carry out an ethnographic based research over a period of 4 months and conduct an in-depth, qualitative case study.

This paper therefore begins by outlining what is known about information and communication technologies (ICT) and related technology before turning to a review of the literature on ICTs relevance and appropriateness to pedagogic practices.

Identifying ICT related technology

It is not un-common to see the acronym ICT especially in the education sector but what is meant by `ICT' is by no means clear. It is therefore paramount to set the context for the evaluation of technology in the context of the education sector. It is also important to note that, generally speaking, there is no one accepted definition of what constitutes ICT related technology.

As stated by Achacos (2003) the term ICT is quite often used to describe variety ways IT related technologies are utilized/liaised in the learning and teaching process. Achacos (2003) further argued that in the class room environment for example, the acronym ICT is used as descriptors for technology used that include but are not limited to: *technology-mediated learning, computer-aided instruction, distance education, computer-based education, technology, multimedia, communications systems, Web-based learning and computer-mediated communication* etc…

The above author also further asserted that the varying nature of technologies appears not to be a matter of disagreement among researchers and evaluators as the term ICT

is used by many to describe, study, and evaluate the various ways IT related technologies integrated into education. It is also true that some authors are specific in describing specific technologies or applications; while other authors simply use the term technology to describe everything electronic.

Moreover, there is no consensus about what constitutes technology in learning or teaching. However, the common link tends to be some use of a computer based system which facilitate teaching or learning process. Though most research studies focus on computer-based technology, there are other teaching and learning technologies that are not computer-based. These can include overhead projectors, TV, VCR, DVD, sound systems, CDs, tape recorders etc…. Some other authors even consider the traditional piece of chalk and chalkboard a type of technology.

Furthermore as argued by Newhouse (2002) sighting Rieber and Welliver (1989) what constitutes an educational technology is unclear. However Rieber and Welliver (1989) defined it as a process involving *"... a systematic approach to identifying instructional problems and then designing, developing, implementing, and evaluating instructional solutions*".

In this MEd research however ICT will be considered as an acronym that could include any type of equipment, inside or outside the classroom that is used to facilitate the teaching and learning process. This of course can include any of the non-computer based technologies mentioned above as well as computerized technologies such as application software or Web-based learning tools.

ICT and Education

According to UNESCO's (1998) World Education Report, educational systems around the world are under increasing pressure to use the new information and communication technologies to teach students the knowledge and skills they need in the 21st century.

The report also states that the radical implications ICT have for conventional teaching and learning. It predicts the transformation of the teaching-learning process and the way teachers and learners gain access to knowledge and information. However as argued by Kennewell (2003) quoting Rushby (1979) the need for evidence concerning ICT's positive effects on learning has been recognized since the early instances of computer assisted learning. However still one generation later, the evidence is still not that much convincing.

Yet it seems that increasing numbers of educators are convinced of ICT's potential despite lack of precise ability to demonstrate clear gains from it. As indicated by BECTA (1998) the utilization of ICT related technology for the education sector (i.e. schools, colleges and universities) increasing as various governments tend to fund the expansion of ICT.

As also stated by TTA (1998) various governments maintain to fund the expansion mainly because of a political conviction that ICT is beneficial for all aspects of life in the 21st century and that education should be able to exploit the features of ICT in the same way as contemporary business does.

Here there are now indications, however, that this investment may not continue unless there is a reassurance or evidence based justifications that learners are benefiting to an extent which is commensurate with the level of provision. A significant body of interpretive research over a number of years has yielded valuable insights into the underlying processes of learning with ICT, but such studies do not directly compare the impact of different factors. It is unlikely that isolated case studies of successful teaching, or detailed interpretive analyses of learning processes, will provide convincing evidence for the political audience.

Newhouse (2002) referred to the ImpaCT2 study as reported by Becta (2002) pointed out that in the UK one research found that, there is no consistent relationship between

the average amount of ICT use reported for any subject at a given key stage and its apparent effectiveness in raising standards.

The above author (i.e. Newhouse (2002) further asserted that while there is no direct link between using ICT and student learning the weight of evidence now clearly shows that indirectly there can be a significant positive impact. Over the last three decades there has been an increasing amount of research conducted to investigate this impact with increasingly clearer findings of positive impacts when ICT is used appropriately. According to Newhouse since learning is mediated through the components of the learning environment and particularly the curriculum (pedagogy and content) it is useful to start with a consideration of the impact of ICT on the curriculum.

There are other sources indicating the relevance of ICTs for supporting education and training at all levels of the educational system in both developed and the developing countries. Furthermore, the introduction of ICTs into the learning process is influencing the educational delivery and support landscape in a number of countries and sub-Saharan countries cannot be an exception. This could be attributed to advances in electronic messaging and computer-mediated multimedia and presentation technologies which are making a major impact on the development, provision and delivery of educational and training programs at all levels of the educational system in most countries of the world and the sub-Saharan Africa which includes Ethiopia.

Technology and Learning

According to Ferguson (1997) one of the first questions that arises in the discussion of educational technology is whether technology increases student achievement. The answer to this question is, "It depends." Ferguson (1997) quoted Ted Hasselbring, a co-director of Vanderbuilt University's Learning and Technology Center in Nashville, USA quoted:

> "It's kind of like asking, 'Are pencils effective?' It depends on what you are going to do with them".

Yes there is an ongoing debate raging among practitioners, researchers and theorists concerning the relevance, appropriateness and effectiveness of using ICT based technology to help students learn. Generally speaking, there is an assumption that technology could enhance learning merely by its use in the educational process.

However Ehrmann (1999) argued that "Technologies such as computers don't have predetermined impacts; it's their utilization that influence outcomes". This statement seems obvious but Achacos (2003) further stated that many institutions act as though the mere presence of technology will improve learning. They use computers to teach the same things in the same ways as before, yet they expect learning outcomes to be better.

There are also equally interesting views about the role and status of technology. Clark, (1983) argues against the view that media by themselves influence the learning process.

Clark (1983) further articulated that

> *"...media are mere vehicles that deliver instruction but do not influence student achievement any more than the truck that delivers our groceries causes changes in our nutrition".*

Achacos (2003) further emphasized on Clark's argument and stated that "….. media do not help students to learn in any circumstance and that the instructional method is the source of the learning,….. ".

However another author Kozma (1994) disputed Clark's argument and stated that "… the more appropriate question was not whether ICT based technologies do influence learning, but will they influence learning".

Kozma (1994) asserted that we have not established a relationship between computer related technologies and learning and this should not mean that one does not exist. He believed that, since we do not fully understand the relationship between media and learning, we have yet to measure and justify it, and the failure to establish this relationship is caused in part by our theories of learning, or more specifically, behaviorism, with its basic assumption that a stimulus causes a response. Thus, in Kozma's view, since the definition learning has evolved to embody more of a constructive process, our measurement of this process must evolve as well.

The above contrasting views are bound to force us to think - who is right? However as a practitioner I will argue that ICT based technology is just a tool but learning is still something that is performed by the individual. I do also agree with Clark that what the educators have to do is utilize the appropriate instructional method into his/her lesson and learning may take place accordingly.

Ruthven and Hennessy (2002) analysed the pedagogical ideas underpinning teachers' accounts of the successful use of computer-based tools and resources to support the teaching and learning of mathematics. In another article Osborne & Hennessy (2003) further asserted that that it is not appropriate to assume simply that the introduction of such technologies (i.e. ICT) necessarily transforms education and they used *science education* as an example. Instead they stated that the critical role played by the teacher, in creating the conditions for ICT-supported learning through selecting and evaluating appropriate technological resources, and designing, structuring and sequencing a set of learning activities.

Osborne and Hennessy (2003) further outlined "*Pedagogy for using ICT effectively*" for science education in the UK and they listed them as follows:

• tools for data capture, processing and interpretation – data logging systems, databases and spreadsheets, graphing tools, modeling environments
• multimedia software for simulation of processes and carrying out 'virtual experiments'
• information systems
• publishing and presentation tools; digital recording equipment
• computer projection technology; computer-controlled microscope
ensuring that use is appropriate and 'adds value' to learning activities
• building on teachers' existing practice and on pupils' prior conceptions
• structuring activity while offering pupils some responsibility, choice and opportunities for active participation
• prompting pupils to think about underlying concepts and relationships; creating time for discussion, reasoning, analysis and reflection
• focusing research tasks and developing skills for finding and critically analysing information
• linking ICT use to ongoing teaching and learning activities
• exploiting the potential of whole class interactive teaching and encouraging pupils to share ideas and findings.

The above authors (i.e. Osborne and Hennessy) further articulated the appropriateness of ICT especially in science education. They identified and discussed a number of reasons for using ICT in science teaching and learning including; expediting and enhancing work production; increasing the currency and scope of reference and experience; supporting exploration and experimentation; fostering self-regulation and collaborative learning and finally, improved motivation and engagement. The British Educational Communications and Technology Agency (BECTAa, 2003) also reported key benefits of using ICT in science education.

ICT and the educators

According to Light (2009) when ICT effectively integrated into a high-quality learning environment, researchers have demonstrated that it can help deepen students' content knowledge, engage them in constructing their own knowledge, and support

the development of complex thinking skills (Kozma, 2005; Kulik, 2003; Webb & Cox, 2004).

Light (2009) further argued that ICT alone cannot create this kind of teaching and learning environment. Educators must know how to structure lessons, select resources, guide activities, and support this learning process; many traditionally-trained teachers are not prepared to take on these tasks. Light (2009) referred to the work of Bransford, Brown, and Cocking (2000) and stated that to use technology effectively, the pedagogical paradigm needs to shift toward more student-centered learning. This shift is not trivial or easily accomplished, particularly in countries with teacher-centered educational traditions.

He then referred to various literatures and summarized that there are four broad sets of changes that should accompany the integration of ICT and the move toward a constructivist model of teaching and learning.

1. *Changes in teachers' knowledge, beliefs, and attitudes*:
2. *Changes in how students engage with content*
3. *Changes in relationships among teachers, students, and parents*
4. *Changes in the use of ICT tools to promote students' learning*:

The above author along with Manso (2006) and Pérez (2003) also referred to a number of factors he thought will help teachers to integrate ICT and to support students' increased use of ICT tools for learning and identified teacher knowledge, time, access to ICT tools, and the alignment of ICT use with pedagogical goals as the main points.

In another article titled "why should teachers be given training to promote effective use of ICT" Dick and Reynolds (1998) pointed out a number of reasons why ICT staff development has become a focus of much attention in education and they have identified the following points:

- constant rapid changes in technology lead to skills being quickly out-dated
- pupils will be living in an information-based society & need appropriate skills
- the use of ICT in schools is being held back by inadequate teacher expertise
- the majority of serving teachers entered the profession before advent of ICT
- many new skills are involved with adopting ICT into teaching - both mechanical and pedagogical

Furthermore Davis (1997) argued that educators must be given sufficient support to enable them to keep up with new developments as they happen. Another author Scrimshaw (1997) highlights how the teacher's role will need to change if ICT is to be used effectively and he stated the educators will need both support in using new technologies and time to try out and reflect on new ways of learning.

Crawford (1997) pointed out a very pragmatic approach and he argued that learning new IT skills is generally a low priority for teachers. He further pointed out that it is partly because of a high work load and sometimes because the value of IT is not recognized in a particular institution. He further asserted that, if the utilization of ICT to genuinely develop within the education sector it must meet be designed to meet the needs of the staff who receive it.

Another author Davis (1997a) in another article acknowledged that there has been greater recognition of the importance of research into IT in education and the education of teachers. According to him, this has been manifested by a "significant increase in the number of policy makers who have stipulated that teachers are the key to ensure that information and communication technologies are applied well, so that citizens have appropriate skills and knowledge for the information society".

These developments have also been set against a background of political change. According to DfEE (1997) in order to address some of the issues above, the UK government for example intends that teachers should "generally feel confident, and be competent to teach, using ICT within the curriculum" by 2002.

From DfEE report one can assume that there is a need for staff development in effective ICT use, geared towards the needs of the educators.

ICT and education in developing countries

There are various evidences which suggest the applications of information and communications technologies (ICT) are making "visible" changes in economic and social development and they acknowledged the fact that the Education industry of course is at the core of learning in society.

Correspondingly, the role of ICT in schools is increasing. In some countries, ICT is now at the centre of education reform efforts that involve its use in coordination with changes in curriculum, teacher training and pedagogic activities.

According to Kozma (2002) countries from Singapore to Chile to the United States to Norway have taken the position that the integration of ICT into classrooms and curricula can improve educational systems and prepare students for the 21st century learning society.

Similarly according to the above author international organizations, such as the Organization for Economic Cooperation and Development OECD (1999) the European Commission (2000), and the G8 nations (2000) have identified the need to prepare students for lifelong learning in the knowledge economy and they assign a central role to ICT in accomplishing this goal.

However how the above development is affecting education reform in the LDC (especially in the sub-Saharan African countries) is not clear. Research carried out by Light & Linden (2008) in developing countries rely on correlation designs to test whether variables are associated with each other and utilize a qualitative or case study approach. Such an approach provides a detailed look into why and how ICTs may be used within educational settings to boost learning outcomes, but not whether their usage leads to desired outcomes over time.

Furthermore there are various evidences indicating that not all countries are currently able to benefit from the developments and advances that ICT based technology can offer. A number of significant issues have been identified but they quite often described as "the Digital Divide" to indicate the limitation to take advantage of the recent technological developments.

According to Chinn and Fairlie (2006) most developing countries have substantially lower rates of computer and Internet penetration than the rates for developed countries. Rates of technology use are especially low in African countries. For example, in Ethiopia there are 0.31 computers and 0.16 Internet users per 100 people.

Unsurprisingly lack of infrastructure and access to ICT based resources is the common one among them. Kozma (2002) sighted the work of Larson (2000) referring to the U.S. State Department that approximately 275 million people have access to online resources at the end of the twentieth century, less than a quarter resided outside North America and Europe.

Furthermore Larson (2000) sighting UNESCO's report, stated that "while over 26% of the U.S. population are Internet users, only 0.8% of the Latin American population are Internet users. The figure for Southeast Asia is 0.5%, for Eastern Europe, 0.4%, for Sub-Saharan Africa, 0.1% and for South Asia, 0.04%.

According to the above author, not having access is the most obvious problem. It is therefore obvious to say that developing countries such as sub-Saharan African are most likely to face other challenges such as in using ICT to improve and reform education, challenges related to teacher preparation, curriculum, pedagogy, and assessment".

Furthermore, in 2005 *info*Dev[1] created a series of "Knowledge Maps" to outline what is known and what isn't about ICT use in education. The above series of papers states despite a large investment in ICTs to benefit education in Organisation for Economic Co-operation and Development (OECD) countries, and increasing use of ICTs in education in developing countries. In addition, according to *info*Dev's knowledge maps there appears to be a serious of useful resources attempting to translate what is known to work and not work in this field.

The UN Millennium Development Goals known as (MDGs) stated that "It is widely acknowledged that it will be impossible for many countries to meet many of the education-related MDGs by the 2015 deadline. In order to realize these goals a fast track initiative known as (FTI) has been created to assist LDC countries (that includes sub-Saharan African countries) in various ways as the UN attempt to meet these targets.

However in "ICTs for Education Reference Handbook", Haddad (2007) pointed out the impact of ICTs for education depends to a large extent on the purpose for which ICTs are used.

[1] *info*Dev's (Information for Development program) is a program of the World Bank and other international development agencies focusing on how the use of ICTs can help to combat poverty and promote opportunity, empowerment and economic growth in LDC countries, a field of activity often referred to as 'ICT for Development', or ICT4D for short.

For example, Haddad (2007) stated **"…**if videos are talking heads and software is digital text, we should not expect learning results significantly different from classroom lecturing or textbook use".

The author of the above hand book also further stated that

> "…. these instructional technologies may extend educational opportunities to situations where there is no lecturer or textbook". Thus the selection of a technology and the way it is used is partially determined by what is expected of it in terms of educational, learning, or teaching objectives".

ICT and Ethiopia

Ethiopia like other developing countries, ICT usage is still at an infancy stage, in spite of Government's effort to promote it. According to the Ethiopian Ministry of Education (MoE) the role that ICTs can play in widening access to education to a wider section of the population cannot be underestimated. ICT therefore praised for assisting and augmenting literacy education and also for facilitating educational delivery and training at all levels and this has been acknowledged in the Ethiopian ICT For Development (***ICT4D***) policy document.

The above policy document also states that the Ethiopian government recognized the key role that ICTs can play in transforming the educational system and making education accessible to the greater proportion of citizens. Furthermore in its five years action plan (i.e. for the year 2006 – 2010) the Ethiopian Ministry of Capacity Building stated that the government is committed to addressing the nation's human resource requirements in the area of ICTs through the promotion of mass ICT literacy education and training and the increase in the use of ICTs in educational institutes (schools, universities and colleges) as well as implementing initiatives aimed at connecting schools and higher educational institutions to the online resources including the Internet.

The document also further states that the Ethiopian government has the vision of vastly increasing the numbers of students within Higher Education Institution (HEIs) and increasing the numbers of universities and university colleges in the country. It therefore intends to simultaneously expand the intake of the newly established 12 new university colleges within the same, short, timescale and this can be achieved by utilizing the ICT based technologies.

However according to Ashcroft (2007) although the Ethiopian government's vision to have the main regions and centres of population to have a (Higher Education Institution) HEI is commendable, the governments' vision needs to be rethought. Ashcroft (2007) further argued that "although the government effort has to be recognized, it is simply not possible to create a university or university college from what on a green field site in a few months without devaluing the idea of a university and the currency of a university education Ashcroft (2007)".

She further argued that it is better to be honest and admit that newly created institutions cannot produce bachelor's level graduates from the very beginning, but in their early years of existence, they can produce useful graduates at an intermediate level between TVET (Technical and Vocational Education & Training) and bachelors programs. This is a level of graduate that the research underpinning this study indicates is badly needed within Ethiopia.

According to the British Parliamentary Office of Science & Technology report of 2006 on ICT policies they sighted Ethiopia as an example. The report stated that

> "…in Ethiopia 40% import tariffs on ICT equipment makes it too costly for all but the elite. The incumbent public telecom operator has a monopoly over all telecom services. Although the number of mobile phone subscribers is growing, uptake in Ethiopia is among the lowest in Africa. About 60% of telephones and 94% of the 6,000 internet accounts are concentrated in the capital, Addis Ababa.

The report further stated that

> …this is due to the limited telecom infrastructure, low levels of computerization outside the capital and lack of human resources. However the British Parliamentary Office of Science & Technology stipulated that "Ethiopian government's attitude to ICT may be changing, with the establishment of an Ethiopian ICT development Authority, and changes in management of the two key telecommunications agencies

Despite the enthusiasm which is reflected in the Ethiopian government policy document there are also other authors who question the lack of appropriate evidence to highlight the resources spending for technology which is not being empirically evaluated.

In article titled "What does research tell us about technology and higher learning?" Ehrmann (1995) stated that:

> *All of us wish we had good data about teaching, learning, and technology, but few institutions are doing the work to get it. That's dangerous. Technology changes quickly and unpredictably, IT budgets are large and getting larger, and money remains tight. Lacking data, faculty and administrators make big investments of time and money with their eyes closed. In today's world, it is important to get information that helps us see what we are doing, fix problems, and document achievements"* Ehrmann (1995).

However in the case of Ethiopia, despite the above limitations and criticism the role ICT can play in widening access to education to a "relatively" wider section of the population has been accepted and various ICT related technologies are now being deployed to support teaching, learning, at different levels of the educational system from primary school to university level.

Conclusion

This paper provided a summary of the relevant literature from the ICT and the education field, which serves as the context for this study. The paper centred on the role and relevance of ICT as the focus of the research, particularly highlighting the practical and problem-centred literature from which the issues relevant in the context of developing nations.

The literature suggests that ICT is important in terms of supporting the pedagogic practices around the world. Furthermore, it may offer promising solutions or alternatives to many pedagogic related limitations. However, much of the literature lacks a solid theoretical base from which to seek a clearer understanding. Neither the ICT nor the education literature has much to say about ICT in least developing nations. In fact, it could be argued that there are significant 'gaps' in both literatures regarding the link between ICT and pedagogy.

REFERNCES

Achacoso**,** M. (2003). Evaluating Technology and Instruction: Literature Review and Recommendations**,** The University of Texas at Austin

Ashcroft, K. (2005). Analysis and Discussion of Curriculum, Resource and Organizational Issues. Higher Education Strategy Center. Retrieved March 24, 2010, from www.higher.edu.et

Becta, (2002). *The Impact of Information and Communication Technologies on Pupil Learning and Attainment.* (ICT in Schools Research and Evaluation Series – No.7): DfES.

Boonstra, A., Boody, D. and Bell, S. (2008). Stakeholder management in IOS projects: analysis of an attempt to implement an electronic patient file, *European Journal of Information Systems*, University of Gronningen, The Netherlands

Bourgois, Philippe I. (1995). *In Search of Respect: Selling Crack in El Barrio*. Cambridge University Press, Cambridge.

Bransford, J. D., Brown, A. L., & Cocking, R. R. (Eds.) (2000). *How people learn: Brain, mind, experience, and school*. Washington, DC: National Research Council/National Academy Press.

British Parliamentary Office of Science & Technology report on ICT in developing countries (2006). Vol. No: 261. Retrieved January 7, 2010 from http://www.parliament.uk/documents/post/postpn261.pdf

Chinn, M.D. & Fairlie, R.W. (2006), "The Determinants of the Global Digital Divide: A Cross-Country Analysis of Computer and Internet Penetration," forthcoming, *Oxford Economic Papers*.

Clark, R.E. (1994). Media will never influence learning. *Educational Technology Research and Development, 42*(2), 21-29.

Clark, R.E. (1983). Reconsidering research on learning from media. *Review of Educational Research, 54*(4), 445-459.

Crawford. R. (1997). Managing Information Technology in Secondary Schools London and New York: Routledge.

Davis, N. (1997c). Strategies for staff and institutional development for IT in education: An integrated approach In Somekh, B. and Davis, N. (Eds.). Using Information Technology effectively in Teaching and Learning: Studies in Pre-Service and In-Service Teacher Education London and New York: Routledge.

Denzin, N. & Lincoln, Y. (1998). Strategies of Qualitative Research. *Thousand Oaks, CA: Sage Publications.*

Dick, M. & Reynolds, A, 1998. Reflection on two case studies of staff development with small group . Retrieved February 15, 2010 from http://www.adastral.demon.co.uk/ma3/assignment/offl_res.htm

Edwards, P. & Belanger, J. (2008). Generalizing from workplace ethnographies. *Journal of Contemporary Ethnography*, 37 (3), 291-313.

Ehrmann, S.C. (1995). What does research tell us about technology and higher learning? *Change, 27(2)*, 20-27. Retrieved January, 2010 from http://www.learner.org/edtech/rscheval/rightquestion.html

Ernst, D. (2002). Global production networks and the changing geography of innovation systems: Implications for developing countries. *Economics of Innovation and New Technology*, 11 (6), 497-523.

Ethiopia, Ministry of Capacity Building (2005), *National ICT for Development 5 years Action Plan* for the year 2006 – 2010

Ethiopia, Ministry of Education. (2006). *Education Sector Development: Programme Action plan* for the year 2006 – 2011

Ethiopia, Ministry of Education. (2005). Education Sector Development Programme III (ESDP-III): Program Action Plan. .

European Commission (2000). Communication from the commission to the council and the European Parliament: The e-learning action plan – Designing tomorrow's education. Brussels: Commission of the European Communities.

Feller, G. (2005). 'ICT Policy of Ethiopia: changing positively', *Information for Development (I4D)*, vol3 no6 (2005), pp 28-29

Ferguson, B., (1997), Education Technology: *An extended literature review* Retrieved March 25, 2010 from http://www.sdavjr.davis.k12.ut.us/~brian/ferguson/pdf_files/Exlitrev.pdf

G8 Countries (2000). Okinawa Charter on the Global Information Society.Retrived 03/04/2010 from http://www.dotforce.org/reports/it1.html.

Fine, G.A. & Holyfield, L. (1996). Secrecy, trust and dangerous leisure: Generating group cohesion in voluntary organizations. *Social Psychology Quarterly*, 59, 22-38.

Hare, H. (2007). ICT in Education in Ethiopia. Retrieved April, 21, 2010 from http://www.infodev.org/en/Document.402.pdf

Hennessy, S., Deaney, R., & Ruthven, K. (2003). Pedagogic strategies for using ICT to support subject teaching and learning: An analysis across 15 case studies. *Research Report No. 03/1*. Cambridge: University of Cambridge.

Kennewell, S., (2003). Developing research models for ICT-based pedagogy, University of Wales Swansea, Department of Education – Retrieved November 3, 2009 from http://portal.acm.org/citation.cfm?id=857119

Kozma, R. (1983). Reconsidering research on learning from media. *Review of Educational Research, 53*(4), 445-459.

Kozma, R. (1991). Learning with media. *Review of Educational Research, 6*1(2), 179-211.

Kozma, R. (1994). Will media influence learning? Reframing the debate.

Kozma, R. (2002). Qualitative Case Studies of Innovative Pedagogical Practices Using ICT. Journal of Computer Assisted Learning 18: 387-394. Kozma, R. (2005). National policies that connect ICT-based education reform to economic and social development. *Human Technology, 1*(2), 117–156.

Kulik, J. (2003). *Effects of using instructional technology in elementary and secondary schools: What controlled evaluation studies say* (Final Report No. P10446.001). Arlington, VA: SRI International.

Kuriyan, R., Ray, I. & Toyama, K. (2008). Information and Communication Technologies for Development: The Bottom of the Pyramid Model in Practice, Infromatio0n Society Vol. 24 Issue 2, p93-104

Larson, A. (2000). Remarks delivered at the Sovereignty in the Digital Age Series. Washington, D.C.: Woodrow Wilson Center.

Lee, A. & Baskerville, R. (2001). Generallizing , Generalizabilty in Information Systems Research.

Levina, N. (2005). Collaborating on Multiparty Information Systems Development Projects: A Collective Reflection-in-Action View, Information Systems Research, Vol. 16. No 2, pp 109-130

Lewis, D. (2008). Using life histories in social policy research: The case of third sector/public sector boundary crossing. *Journal of Social Policy*, 37 (4), 559-578.

Light, D., & Manso, M. (2006, April). *Educational technology integration in developing countries: Lessons from Seven Latin America SchoolNets.* Paper presented at the Annual Meeting of the American Educational Research Association. Seattle.

Light, D.,(2009). The Role of ICT in Enhancing Education in Developing Countries: Findings from an Evaluation of The Intel Teach Essentials Course in India, Turkey, and Chile Education Development Centre

Linden, L.L. (2008). *Complement or substitute? The effect of technology on student achievement in India.* Infodev Working Paper No. 17. Retrieved November, 5 2009 from http://www.infodev.org/en/Publication.505.html

Mytelka, L.K. & Smith, K. (2002). Policy learning and innovation theory: An interactive and co-evolving process. *Research Policy*, 31, 1467-1479.

Newhouse, P (2002); Literature Review The IMPACT of ICT on LEARNING and TEACHING A literature review by Dr. C. Paul Newhouse for the Western Australian Department of Education.

Ngwenyama, O.K., Introna, D.L., Myers, M.D. and Degross J.I. (1999). New Information Technologies in Organizational Processes: Field Studies and Theoretical Reflections on the Future of Work, Norwell, MA: *Kluwer Academic Publishers*

Organisation for Economic Cooperation and Development (1999). Knowledge management in the learning society. Paris: OECD/CERI.OECD. (2001). *"Information and Communication Technologies and Rural* Retrieved October 11, 2009, from www.sourceoecd.org.

Orlikowski, W. (1991). Integrated Information Environment or Matrix of Control? The Contradictory Implications of Information Technology. *Accounting, Management, and Information Technology, 1*(1), 9-42.

Osborne, J., & Hennessy, S. (2003). Literature review in science education and the role of ICT: Promise, problems and future directions. Report No. 6. Retrieved March 15, 2010 from http://www.futurelab.org.uk/resources/documents/lit_reviews/Secondary_Science_Review.pdf

Pérez, P., Light, D., Vilela, A., & Manso, M. (2003, 2006). Learning from the pioneers: A study on the best practices of the network TELAR. *Interactive Educational Multimedia, 6,* 17–39.

Player-Koro. (2010). How do different modalities of pedagogical practices within teacher education shape student teachers? An empirical study of secondary mathematics teacher education. Retrieved May 1, 2010 from http://bada.hb.se/bitstream/2320/5900/1/Paper_CPK.pdf

Prasad, P. (1997). Systems of Meaning: Ethnography as a Methodology for the Study of Information Technologies. In J. DeGross (Ed.), Information Systems and Qualitative Research. London: *Chapman and Hall.*

Rajpramukh, K.E. (2005). The Shaman in Asia Pacific Region:A Cross Cultural Study. *Man in India*, **85(1 & 2):** 25-40 (2005). Retrieved July 25, 2010 from http://www.krepublishers.com/

Rieber, L. P. (1994). *Computers, graphics, and learning*. Dubuque, IA: Wm. C. Brown Communications.

Rieber, L. P., & Welliver, P. W. (1989). Infusing educational technology into mainstream educational computing. *International Journal of Instructional Media, 16*(1), 21-32.

Rushby N. (1979): *Introduction to Educational Computing.* London, Croom Helm.

Ruthven, K. & Hennessy, S. (2002), 'A practitioner model of the use of computer-based tools and resources to support mathematics teaching and learning', *Educational Studies in Mathematics* 49 (1), pp. 47–88.

Schultze, U. & Leidner, D.E. (2002). Studying knowledge management in information systems research: Discourses and theoretical assumptions. *MIS Quarterly*, 26 (3), 213-242.

Scrimshaw, P. (1997). Computers and the teacher's role In Somekh, B. and Davis, N. (Eds.). Using Information Technology effectively in Teaching and Learning: Studies in Pre-Service and In-Service Teacher Education London and New York: Routledge.

Suchman, L. (1987). Plans and Situated actions: The problem of Human-Machine Communication, Cambridge: Cambridge University Press

Teacher Training Agency (1998). *The Use of ICT in Subject Teaching: Expected Outcomes for Teachers.* London, Teacher Training Agency and the Departments of Education, UK

UNECSO (1998a). World Education Report: Teachers and teaching in a changing world. Retrieved January 25, 2010 from http://www.unesco.org/education/educprog/wer/wer.htm

Webb, M., & Cox, M. (2004). A review of pedagogy related to information and communications technology. Technology, Pedagogy and Education, 13(3), 235–286.

World Bank (1998). Latin America and the Caribbean: Education and technology at the crossroads. Washington, DC: World Bank.

World Bank (1998), *The World Development Report 1998/99. Quoted in Blurton, C., New Directions of ICT-Use in Education.*