Transforming educational practices of Ethiopia into development and the knowledge society through information and communication technology

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ABSTRACT

Despite the improvements in the access to and use of information and communication technology (ICT) around the world, there is evidence which suggest that a persistent digital divide between and within countries. 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. It can improve the quality of teaching-learning and thus contribute to the development of Ethiopia. Nowhere is the ICT gap more evident than in the education system and practices. This study assesses ICTs in supporting educational practices of Ethiopia for transforming into a knowledge- and information-based society and economy. It also focus on the benefits that ICT integration in education system can provide, right from breaking time and distance barriers to facilitating collaboration and knowledge sharing among instructors and students. The paper further argues the role of ICT in transforming teaching and learning and seeks to explore how this will impact on the way programs will be offered and delivered in the universities of the future. The role of the instructor is utterly critical here. Yet a primary barrier to instructors' readiness and confidence in using ICT, despite general enthusiasm and belief in benefits for learners, is their lack of relevant preparation, either initially or in-service. Research indicates that, until recently, training opportunities have remained limited in availability and inconsistent in quality. This has resulted in demonstrably low proficiency in using ICT, and a general lack of knowledge about technology in teaching and learning. There are some recent examples of successful practice in developing ICT use in Ethiopian higher education institutes through its integration. Moreover, the recent global economic downturn has amplified the shortage of public funds to devote to the already expensive business of training instructors to use ICT. Increasingly, large class size and the designation of ICT as a discrete subject, lead to a dire lack of instructors trained to integrate technology into teaching-learning in their areas. These are fundamental challenges to be overcome before ICT capacity building can become a reality in higher education institutes. This paper concludes that regardless of all the limitations characterizing it, ICT benefits education systems to provide quality education in alignment with constructivism, which is a contemporary paradigm of learning. It also identifies a need for instructors and higher education institutes to integrate ICT into teaching and learning using contemporary pedagogical approaches. Finally, it focuses on understanding what a knowledge society is and exploring its relationship to ICT, Education and Development. It thereafter considers trends in ICT integration in Education and Development and highlights some of the challenges in implementing ICT in education initiatives in Ethiopia. Ideally instructors will be assisted to work collaboratively over time with peers, and to learn from one another's innovations and experiences. This requires prioritisation of ICT and continuous professional development that is pedagogically sound and aligned with wider policy interests, and means offering sufficient support and time for instructors to get to grips with new technologies. Underpinning these recommendations is development of locally produced, contextually relevant course content for both instructors and learners.

Keywords: Ethiopia, higher educational institutions, information and communication technology, teaching-learning practices.

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INTRODUCTION

The Ethiopian Government has made the development of information and communication technology (ICT) one of its strategic priorities. The ICT policy stems from the recognition by the Government of ICT as the key driver and facilitator for transforming Ethiopia's predominantly subsistence-agriculture economy and society into an information- and knowledge-based economy and society, effectively integrated into the global economy. The penetration of current ICT trends in education is very important and a priority for educational development and sustainability. ICT penetration in education proliferates in many different forms and most of its realization and influence has to be gained through knowledge and technical know-how. The main stakeholders of the global tertiary education industry are staff and students.

ICT has become common place entities in all aspects of life. For the past twenty years, the use of ICT has fundamentally changed the practices and procedures of nearly all forms of activities within business and governance. Within education, ICT has begun to have 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 (Buabeng-Andoh, 2012). The use of ICT in education has introduced other modes of education other than the traditional mode.

The United Nations (UN, 2015) recognizes ICT as a tool for its attainment, in helping to achieve the MDG agenda on many levels, for example, by contributing directly with its operational activities, building capacity, gathering and assessing data, and by advocating for the agenda's implementation. The UN system is an asset that needs to be put to good use; it can be a motor for assisting countries in achieving their common national and collective Sustainable Development Goals. It is commonly thought that knowledge has replaced industrial organization and production as the major source of productivity (Evers, 2003). The term 'Knowledge Society' generally refers to a society where knowledge is the primary production resource instead of capital and labour. Globalization and the changing world economy are driving a transition to knowledge-based economies. It is facts that a knowledge society is one where growth, development, and innovation are driven by optimal use of information and information products. The role of ICT in development was also recognized in Kifle et al. (2010) as well as in which Ethiopia has been actively participating. Countries worldwide are using ICT as the driving force by successfully exploiting the opportunities it presents for their social and economic transformation. Towards this end they have adopted policies as a framework for the exploitation and application of ICT. Ethiopia has already embarked on several initiatives to promote the development and application of ICT in recognition of its role for national development. The scope of Ethiopia's ICT policy covers knowledge and information as a tool for development, as well as the development of ICT as a sector or industry.

Education is of vital importance in the knowledge society, as a source of basic skills, as a foundation for development of new knowledge and innovation, and as an engine for socio-economic development. Education is, therefore, a critical requirement in creating knowledge societies that can stimulate development, economic growth, and prosperity. Learning in the knowledge-based society is considered to be holistic, as it is a lifelong activity and cuts across different learning generations and life spheres (private, public and work). The focus should not be confined to traditional formal learning institutions such as schools and universities; and existing training organizations and training practices, but also embraces adult education, informal learning and workplace-based learning. The potential impact of ICT on learning is the vision that it enables learning 'anywhere, anytime, and anyhow'. 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.

ICT does not automatically add quality, relevance and accessibility to teaching and learning. It is possible to use information and communication technologies for trivial purposes, to waste students' time with ICT or even worse, to use ICT for destructive or immoral purposes. We can certainly use ICT to further entrench inequalities and to favour particular groups. There is evidence, for example, that African American and Hispanic students are given more repetitive drill and practice tasks on computers and fewer sophisticated simulation applications than their white peers (Chen et al., 2011; Condie and Munroe, 2007; Light, 2009).

ICT plays an ever important role in increasing economic productivity through digital economies, enhancing the delivery of public and private services and achieving broad socio-economic goals in education, health care, employment and social development. As a result, countries are advancing ICT policies to underpin growth in a variety of socio-economic sectors and help steer development and competition.

In the education sector, policy makers widely accept that access to ICT can help individuals to compete in a global economy by creating a skilled work force and facilitating social mobility. They emphasise that ICT in education has a multiplier effect throughout the education system by UNESCO-UIS (2015):

1. Enhancing learning and providing students with new sets of skills;

2. Reaching students with poor or no access (especially those in rural and remote regions); facilitating and improving the training of teachers; and
3. Minimising costs associated with the delivery of traditional instruction.

ICT in Ethiopia at present is at the very early stage of development. Nearly the entire rural population lacks telecommunication infrastructure. The vast majority of the population is dependent only on the conventional and traditional information delivery system, the radio or newspapers. This paper therefore begins by outlining what is known about ICT and related technology before turning to a review of the literature on ICTs relevance and appropriateness to pedagogic practices. In order to explore and conceptualise the extent of ICT support accounting education and practices and its impact in Ethiopian transformation, the review attempts to answer the following questions:

1. What are the existing promises of ICT use in transforming educational practices of Ethiopia into development and the knowledge society?
2. What can ICT do to assist the instructors in transforming Ethiopia into a knowledge- and information-based society and economy?
3. What are the limitations and key challenges of ICTs use in transforming educational practices of Ethiopia into development and the knowledge society?

THE RATIONALE BEHIND THE FOCUS ON ICT IN EDUCATION

It is not uncommon 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 Light (2009) the term ICT is quite often used to describe variety ways IT related technologies are utilized/liaised in the learning and teaching process. Levina (2005) further argued that in the classroom 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.

Instructors all have our own interpretations on how we learn or teach. These interpretations are influenced by our unique epistemological beliefs. As individuals, instructors or learners, instructors bring with us different epistemological approaches that stem from our past unique learning experiences and educational value systems (Chandra and Patkar, 2007). Therefore, we could have different yardsticks, or perspectives, on what is considered to be effective learning and teaching. (Table 1)

The following sections are some perspectives on how we learn. In order to put these perspectives in context, the researcher also included some examples of how technology could be applied to achieve these perspectives.

Behavioral perspectives

According to behavioral perspectives, learning is not self-initiated but rather is a reactive behavior. Learners learn only by responding to external stimuli and corrective feedback (Carvalho et al., 2011). The responsibility of teaching and achieving correct learning outcomes would mostly belong to the teachers or program designers. Typical examples of technology could be applied to achieve these perspectives:

i) Programmed sequenced incremental learning procedure;
ii) Built-in tutor or agent in the program to guide each step;
iii) Automatic positive reinforcements for correct answers; and
iv) Repeated drills to overcome errors until corrected.

Cognitive perspectives

According to the cognitive perspectives, learning is natural and hierarchical, and learners come with certain background of experience and value system (Mooij, 2007). As a result, knowledge and skills could be stored and transferred from the short-term memory of surface learning to the long-term memory of deep learning which could be retrieved later for application purpose (Mooij, 2007). The responsibility of learning is mainly on the students and teaching activities should be predesigned according to the different needs of students. Typical examples of technology could be applied to achieve these perspectives:

i) Hypertext base hierarchical learning framework;
ii) Interactive learning activities that would address and guide the different hierarchical learning events;
iii) Multimedia simulation of knowledge application; and
iv) Interactive self assessment with customized

Table 1. Expected changes from education in the industrial society to education in the information.

Actor	Education in the industrial society	Education in the ICT society
School	Isolated from society Most information on school functioning confidential	Integrated in society Information openly available
Teacher	Initiator of instruction Whole class teaching Evaluates student Place low emphasis on communication skills	Helps students find appropriate instructional path Guides students' independent learning Help students to evaluate own progress Place high emphasis on communication skills
Student	Mostly passive Learns mostly at school Hardly any teamwork Takes questions from books or teachers Learns answers to questions Low interest in learning	More active Learns at school and outside school Much teamwork Ask questions Finds answers to questions High interest
Parent	Hardly actively involved in learning process No steering of instruction No life-learning model	Very active in learning process Co-steering Parents provide model

Source: Ozdemir and Abrevaya (2007).

constructive feedback.

There are several levels on which ICTs can push the cognition boundaries. New media allow us to represent in rich and diverse ways. This is not simply a matter of learning styles although diverse learning styles can be supported by ICT. New media enable us to traverse the boundaries of art, science, language and senses. They allow us to represent and simulate experience. ICT allows us to accelerate or decelerate processes for purposes of understanding. Just as an experiment allows us to reproduce, represent or test a pattern of activity in the physical world, multimedia allows us to represent and experiment in a 'virtual' world – transferring control and concept to the learner in new ways. We can improve safety, for example, using technology (the difference between a flight simulator and learning in the air) so that the concepts are transferred, confidence is built through simulated experience and skills are developed, long before the risk has to be taken.

Constructivist perspectives

According to the constructivist perspectives, learning is also natural and selfinitiated. Learning takes place as transforming new information as building blocks to become parts of their existing schema when learners identify the relevance of the new information. Learning is most meaningful when they learn in a social context and if the outcomes would help them to solve immediate work or social challenges (Mooij, 2007; Krumsvik, 2009). The

responsibilities of learning and teaching could be reciprocal between learners and teachers. Examples of technology being used to implement these perspectives are as follows:

i) Flexible interactive learning framework to hold independent learning modules;
ii) Virtual collaborative projects;
iii) Multi-media case studies with multi perspectives and real world problems; and
iv) Online video broadcast or conferences for asynchronous and/or synchronous discussions.

The researcher 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. Changes in:

1. Teachers' knowledge, beliefs, and attitudes;
2. How students engage with content;
3. Relationships among teachers, students, and parents; and
4. The use of ICT tools to promote students' learning.

The above author along with Manso (2006) and Mooij (2007) 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. Mehta and Kalra (2006) claims: Everyone knows

what a culture is – it is a place for growing things, and schools are places for growing minds (Ozdemir and Abrevaya, 2007). The curricula instructors offer and the teaching methods instructors employ are means for creating minds. It is in a sense that the curriculum is a mind-altering device (Kuriyan et al., 2008) and the school a culture of growing minds. As this conception of mind takes root in our conceptual life, it creates an optimism for education for it emphasises the possibilities of schooling, its capacity to make a difference in the kind of minds that students can come to own.

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

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. This shift is not trivial or easily accomplished, particularly in countries with teacher-centered educational traditions in Ethiopia. In another article titled "why should teachers be given training to promote effective use of ICT" Dick and Reynolds cited in Buabeng-Andoh (2012) 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:

i) Constant rapid changes in technology lead to skills being quickly out-dated;
ii) Pupils will be living in an information-based society & need appropriate skills;
iii) The use of ICT in schools is being held back by inadequate teacher expertise;
iv) The majority of serving teachers entered the profession before advent of ICT; and
v) Many new skills are involved with adopting ICT into teaching - both mechanical and pedagogical.

Furthermore, Gaible (2007) argued that educators must be given sufficient support to enable them to keep up with new developments as they happen. Another author Plomp et al. (2007) 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. Kozma (2005) pointed out a very pragmatic approach and he argued that learning new ICT skills is generally a low priority for teachers. He further pointed out that it is partly because of a high workload and sometimes because the value of ICT 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.

Gaible (2007) 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. (Table 2)

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 as:

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

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 systems which facilitate teaching or learning process. Though, most research studies (Condie and Munroe, 2007) 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) what constitutes an educational technology is unclear. However, Hare (2007) defined it as a process involving "a systematic approach to identifying

Table 2. Benefits of ICT in education to the main stakeholders.

Stakeholder	Benefits
Student	Increased access
	Flexibility of content and delivery
	Combination of work and education
	Learner-centred approach
	Higher quality of education and new ways of interaction
Employers	High quality, cost effective professional development in the workplace
	Upgrading of employee skills, increased productivity
	Development of a new learning culture
	Sharing of costs and of training time with the employees
	Increased portability of training
Governments	Increase the capacity and cost effectiveness of education and training systems
	To reach target groups with limited access to conventional education and training
	To support and enhance the quality and relevance of existing educational structures
	To ensure the connection of educational institutions and curricula to the emerging networks and information resources
	To promote innovation and opportunities for lifelong learning

Source: Trucano (2007).

instructional problems and then designing, developing, implementing, and evaluating instructional solutions."

According to UNDP (2012) 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), 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 Ernst (2002), the utilization of ICT related technology for the education sector (that is, schools, colleges and universities) increasing as various governments tend to fund the expansion of ICT. 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.

As also stated by Chen et al. (2011), 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.

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. 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. ICTs have the potential to accelerate, enrich, and deepen skills, to motivate and engage students, to help relate school experience to work practices, create economic viability for tomorrow's workers, as well as strengthening teaching and helping schools change (Buabeng-Andoh, 2012; USAID, 2012). 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.

The use of ICT may foster co-operative learning and reflection about the content (Light, 2009). 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 (Carvalho et al., 2011). Hence ICTs can enhance the quality of education in several ways, by increasing learner motivation and engagement, by facilitating the acquisition of basic skills, and by enhancing teacher training. ICTs are also transformational tools which, when used appropriately, can promote the shift to a learner centered environment. ICTs, especially computers and Internet technologies, enable new ways of teaching and learning rather than simply allow teachers and students to do what they have done before in a better way. ICT has an impact not only on what students should learn, but it also plays a major role on how the students should learn.

How to assess the impact of ICT on education?

The institution should first examine the rationale and define the right criteria for the evaluation and selection of technology to enhance instruction. It also preliminary answers to three broad questions (Feller, 2005; Kifle et al., 2010):

i) How is ICT currently being used in the education sector, and what are the strategies and policies related to this use?
ii) What are the common challenges and constraints faced by countries in this area?
iii) What is actually happening on the ground, and to what extent are donors involved?

When? Evaluating technology for instructional purposes begins with a specific learning objective. Will a technology enhance the engagement of the student in their learning in some way? Will a technology assist the instructor to be more effective, efficient, or engaging?

How? Consider that question: Will this technical solution assist to achieve the targeted learning objective "better, faster safer, easier, or cheaper" in one of those 3 areas listed above? If so, then there is solid rationale to explore the use of the tool or approach or solution for instructional purposes.

Why? to explore and understand learning and to practice what learning-centred teaching really means:

i) To add interaction, engagement, and visual appeal to instruction.
ii) To provide student access to student-generated content beyond the end of the term.
iii) To blur the boundaries of the classroom "box" to take students out into the real world and to bring experts in to the classroom.
iv) To help students learn to use technology for academic and professional purposes.
v) To help students learn how to be safe online and to manage and control their online digital footprints.
vi) Because it is important to explore, test, evaluate, and learn – continuously improving.
vii) Because it is important for the future of our students that their instructors participate, evaluate, document, expose and engage their students in this process of connected life-long learning.
viii) To improve student engagement and learning.

Kozma (2008) has highlighted this in his work, and he acknowledges that ICT strategies in many countries cut across diverse fields:

i) Infrastructure development is necessary in order to ensure access to schools, networks and resources for learning.
ii) Teacher training, both initial and in-service, is a prerequisite for the ability of education to use ict in learning processes.
iii) Technical assistance is needed both in the administrative as well as in the pedagogical domain.
iv) Curricula and pedagogical approaches may have to be changed in order to cater for educational change with ICT.
v) Content development is necessary in order to facilitate the interactive potential ICT can offer in the teaching and learning process.

ICT AND LEARNING-TEACHING PRACTICES

When the Internet paves way for atoms that are

Table 3. The extent of information and communication technology enhancement of learning-teaching.

Opportunity	Dilemma
Learners have the freedom of choice to decide their own time, place, pace, or path to study.	Learners are not able to fully take advantage of the opportunities. the educational experience of most Hong Kong students are "spoon-fed", therefore, they are reactive rather than proactive to learn.
Learning materials could be designed with various entry and exit points that allow the learners to formulate their own learning strategy.	Learners who are used to a teacher center environment would be weak in self directing their study or formulating their own study strategy.
Learners can use the on-line materials as preview or/and review depending on their background and knowledge levels.	Learners visit the on-line materials or activities mostly only before. Examinations, therefore, they would find the learning experience overwhelming, unclear, and hard to digest.
Learners would enjoy the freedom to study at their home and avoid early classes or commuting in heavy traffic.	Some learners, mostly undergraduates, actually miss the physical congregation at a centralized place to learn. this appears to be a deep rooted institutionalised concept that exists in our learners, not to mention their social needs to elicit and validate learning experiences with peers.
Learning materials that are enhanced with various media such as sound, narration, video, animation, graphics, etc. provide learners choices to enhance their different intelligence or learning styles.	When students are not clear how to use the media to their advantage, they would end up having information overload and printing everything they see or hear.

Source: Carvalho et al. (2011).

transformed to bits, access to information or products are no longer constrained by location, time or access mode (Chandra and Patkar, 2007). Freedom of choice is here. However, Carvalho et al. (2011), a veteran instructional technologist, would find her learning experience via the Internet as: "The beauty of 'anywhere, anytime, whenever you want, ' too readily turns into 'not now, maybe later, and often not at all." (Table 3)

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, Chandra and Patkar (2007) argued that "Technologies such as computers do not have predetermined impacts; it is their utilization that influence outcomes". This statement seems obvious but Achacoso (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. Krumsvik (2009) argues against the view that media by themselves influence the learning process. Krumsvik 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".

Achacoso (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 (2005) disputed Krumsvik's argument and stated that "… the more appropriate question was not whether ICT based technologies do influence learning, but will they influence learning". Kozma (2005) 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 of 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 Krumsvik (2009) that what the educators have to do is utilize the appropriate instructional method into his/her lesson and learning may take place accordingly.

Kifle et al. (2010) 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, Kuriyan et al. (2008) further asserted that it is not appropriate to assume simply that the introduction of

such technologies (that is, 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.

Some of factors/challenges in integrating ICT into teaching-learning practices are:

i) Disaggregated content that can be matched to specific topics in the curriculum;
ii) Flexibility for teachers to choose what works for specific curriculum topics and groups of students;
iii) Payment on the basis of what is used;
iv) The capacity to alter content use in response to test results;
v) The capacity to change teaching methodology in response to test results;
vi) The capacity to link content use to a range of other data about students, teachers and the learning; process in order to analyse data, diagnose need, restructure programs and redirect resources; and
vii) The capacity to allocate funding to the level of the teacher on a daily basis in response to diagnostic data.

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.

Moreover, Hennessy et al. (2003) further outlined "*Teaching-Learning for using ICT effectively*" for educational practices and they listed them as follows:

i) Tools for data capture, processing and interpretation– data logging systems, databases and spreadsheets, graphing tools, modeling environments;
ii) Multimedia software for simulation of processes and carrying out 'virtual experiments';
iii) Information systems;
iv) Publishing and presentation tools, and digital recording equipment;
v) Computer projection technology; computer-controlled microscope ensuring that use is appropriate and 'adds value' to learning activities;
vi) Building on teachers' existing practice and on pupils' prior conceptions;
vii) Structuring activity while offering pupils some responsibility, choice and opportunities for active participation;

viii) Prompting pupils to think about underlying concepts and relationships; creating time for discussion, reasoning, analysis and reflection;
ix) Focusing research tasks and developing skills for finding and critically analysing information
x) Linking ICT use to ongoing teaching and learning activities; and
xi) Exploiting the potential of whole class interactive teaching and encouraging pupils to share ideas and findings.

Hennessy et al. (2003) further articulated the appropriateness of ICT especially in education practices. They identified and discussed a number of reasons for using ICT in teaching and learning process 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.

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 and Cox, 2004; Kuriyan et al., 2008).

ICT AND EDUCATION IN DEVELOPING COUNTRIES LIKE ETHIOPIA

There are various evidences which suggest that the applications of information and communication technologies (ICTs) 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 (Carvalho et al., 2011). ICT is therefore praised for assisting and augmenting literacy education and also for facilitating educational delivery and training at all levels. The ICT 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.

The goal of the ICT policy is to vigorously promote an ICT-driven socio-economic development process and transform Ethiopia from an agriculture-based economy and society to a predominantly knowledge- and information-based economy and society with deep rooted democratic culture and good governance. The broad objectives of the ICT policy are to:

i) Develop ICT as a globally competitive industry, and as an engine of growth;
ii) Create the necessary conditions for the rapid development of ICT within the economy and society to

accelerate Ethiopia's socio-economic development process;
iii) Promote and facilitate an extensive use of ICT in support of key sectors of the economy including agriculture, industry and the services sectors;
iv) Transform Ethiopia into a knowledge- and information-based society and economy; and
v) Promote the use of ICT for modernizing the civil and public service to enhance its efficiency and effectiveness for service delivery, to promote good governance and reduce wastage of scarce resources.

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.

Ethiopia's ICT policy assigns a strategic role to ICT human resources development along the following objectives (Feller, 2005):

i) To formulate and implement a comprehensive ICT human resource development policy and strategy;
ii) To improve the overall human resource and skill-base within the civil and public service;
iii) To train professionals within the civil and public sector to operate and manage computer systems in government ministries and agencies;
iv) To increase the supply of adequately trained ICT personnel, particularly in the area of engineering, electronics, computer hard- and soft-ware, telecommunications, etc;
v) To establish career structures for ICT professionals;
vi) To develop national guidelines, standards and curricula for ict education at all levels;
vii) To establish an accreditation system for ICT education and training centers and institutions in the public and private sectors;
viii) To designate an ICT center of excellence from amongst ICT training institutions, universities or colleges; and
ix) To encourage and promote collaborative industry-academic networks for sharing knowledge, experiences and best practices.

In Ethiopia like other developing countries, ICT usage at university/college level is still at an infancy stage, in spite of Government's effort to promote it. According to the Ethiopian Ministry of Education (MoE, 2006), the role that ICTs can play in widening access to education to a wider section of the population cannot be underestimated. ICT is 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 (2006 to 2010) the Ethiopian Ministry of Capacity Building (2005) 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 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* (FDRE, 2010). 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.

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.

Haddad (2007) 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.

Also, the document 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 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."

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 make 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 an article titled "What does research tell us about technology and higher learning?" Cross and Adam (2007:95) 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.

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 as follows:

At the university level

i) Those schools that worked holistically achieved the best results in terms of university development;
ii) ICT was also more integrated into pedagogical practices;
iii) There were divisions and conflicts in the teaching staff at most universities, but there were major variations in relation to how this was handled by the university leaders;
iv) Over the course of the period, a majority of the pilot universities attained a larger contact network vis-à-vis the local community; and
v) The significance of easing the transition between the university levels was documented.

School administrators

i) Pilot as a project involving the whole university community was challenging for university administrators; and
ii) The majority of principals reported that the university had initiated changes in activities in the university organisation due to the integration of ICT, such as no longer using paper for sending out messages and instead putting them on the local network.

Pupils and instructors

i) They focused on the importance of professionalising the teaching profession;
ii) Pupils want a teacher who is a clear academic and pedagogical leader even though ICT is used more extensively;
iii) The majority of instructors were uncertain about the pedagogical use of ICT;
iv) Instructors believed that ICT has a positive effect on students' performance, that it creates more flexibility and differentiation, and that this tendency was amplified during the course of PILOT.
v) After the introduction of ICT, instructors experienced a positive change in their work day that intensified during the period.
vi) There is often a small group of enthusiastic instructors running the activities. Activists are important.

Sustainability

i) The university leaders reported that they would continue the restructuring efforts and ICT work after pilot had finished;
ii) Learning communities help create a basis for and support change processes;
iii) In the majority of universities, the pilot activities gained

a stronger local foundation;

iv) The impact of ICT use on learning outcomes is unclear, and open to much debate; and

v) Widely accepted, standard methodologies and indicators to assess the impact of ICT in education do not exist; and

vi) 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).

Current implementation of ICT in education: Interest in and use of ICT in education appears to be growing, even in the most challenging environments in developing countries.

Policy lessons learned and best practices: Best practices and lessons learned are emerging in a number of areas, but, with few exceptions, they have not been widely disseminated nor packaged into formats easily accessible to policymakers in developing countries, and have not been explicitly examined in the context of the education-related MDGs.

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 results provided by both the quantitative and qualitative analysis of the literature obtained will be exposed especially regarding those aspects which are related to ICTs for Education and ICTs in Education. ICTs for education refers to the development of information and communications technology specifically for teaching/learning purposes, while the ICTs in education involves the adoption of general components of information and communication technologies in the teaching learning process. Extrapolating current activities and practices, the continued use and development of ICTs within education will have a strong impact on: ICT and teaching learning process; quality and accessibility of education; learning motivation, learning environment and ICT usage and academic performance.

The adoption and use of ICTs in education have a positive impact on teaching, learning and research. ICT can affect the delivery of education and enable wider access to the same. In addition, it will increase flexibility so that learners can access the education regardless of

time and geographical barriers. ICT integration in education has its merits. Its use not only changes the traditional ways of teaching, but also requires instructors to be more creative in adapting and customizing their own teaching materials and strategies. Among all the teaching methods and strategies, collaborative learning, problem-based learning and the constructivist approach are the most widely used teaching strategies. This corresponds with the suggestion of that technology integration will not have the desired effect without student-centered classroom practices. Therefore, ICT integration in education cannot be implemented in isolation. When it is applied in combination with diverse teaching methods and approaches, especially constructivist practices, learning outcomes can be more successful.

Further, this paper has sought to explore the role of ICT in education as we progress into the 21st century. In particular the paper has argued that ICTs have impacted on educational practice in education to date in quite small ways but that the impact will grow considerably in years to come and that ICT will become a strong agent for change among many educational practices. Extrapolating current activities and practices, the continued use and development of ICTs within education will have a strong impact on: What is learned; how it is learned; when and where learning takes place; and who is learning and who is teaching.

The upshot of all this activity is that we should see marked improvements in many areas of educational endeavour. Learning should become more relevant to stakeholders' needs, learning outcomes should become more deliberate and targeted, and learning opportunities should diversity in what is learned and who is learning. At the same time, quality of programs as measured by fitness for purpose should continue to grow as stakeholder groups find the offerings matched to their needs and expectations.

To ensure that the opportunities and advantages are realized, it will be important as it is in every other walk of life to ensure that the educational research and development dollar is sustained so that education at large can learn from within and that experiences and activities in different institutions and sectors can inform and guide others without the continual need for re-invention of the wheel. Once again ICTs serve to provide the means for much of this activity to realize the potential it holds. As society changes, the skills that teacher need to be successful in life also change. Basic literacy skills like reading, writing, and mathematics are no longer sufficient. Our teacher need to master the skills like thinking, finding, creating, evaluating, analyzing and applying new content understanding with great flexibility. So use of ICT is t he only thing which can implement and advance the teaching process more advanced.

Changes in the curriculum do support fundamental economic and social transformation in the society. Such

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

The rapid increase and proliferation of technologies has complicated its adoption and integration by instructors in classrooms of training and tertiary institutions. Using current technologies in training and tertiary institutions requires encouragements of adoption, integration and onward involvement of the technological tools and facilities. Effectively integrating technology into classroom practices poses more challenges to teachers, students and institutions as compared to connecting computers to a network and setting up a computer laboratory.

ICT can affect the delivery of education and enable wider access to the same. In addition, it will increase flexibility so that learners can access the education regardless of time and geographical barriers. It can influence the way students are taught and how they learn. It would enable development of collaborative skills as well as knowledge creation skills. This in turn would better prepare the learners for lifelong learning as well as to join the industry. It can improve the quality of learning and thus contribute to the economy.

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

For successful integration of ICT into teaching for enhancement of quality education, this paper through relevant literature has outlined and highlighted on factors that positively or negatively influence instructors' use of ICT in training and tertiary institutions. It can influence the way students are taught and how they learn. It would provide the rich environment and motivation for teaching learning process which seems to have a profound impact on the process of learning in education by offering new possibilities for learners and teachers. These possibilities can have an impact on student performance and

achievement. Similarly wider availability of best practices and best course material in education, which can be shared by means of ICT, can foster better teaching and improved academic achievement of students. Both instructors and students want to use ICT tools more but they didn't utilize it as much as they want. So it can be concluded that there is an incompatibility between interest level of instructors and students to apply the technology though the provision of ICT tools provided by officials and responsible bodies at different levels is minimal. That is, the low level of ICT infrastructures hampered the integration of ICT in the teaching-learning process. Instructors do not use some ICT tools in the teaching-learning process.

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.

REFERENCES

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

Ashcroft, K. (**2007**). Analysis and Discussion of Curriculum, Resource and Organizational Issues. Higher Education Strategy Center. Retrieved March 24, 2014, 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.

British Parliamentary Office of Science & Technology report on ICT in developing countries (**2006**). Vol. No: 261. Retrieved January 7, 2015 from http://www.parliament.uk/documents/post/postpn261.pdf.

Buabeng-Andoh, C. (**2012**). Factors influencing teachers' adoption and integration of information and communication technology into teaching: A review of the literature. International Journal of Education and Development using Information and Communication Technology, 8(1): 136-155.

Carvalho, A., Klarsfeld, L., and Lepicard, F. (**2011**). Leveraging Information and Communication Technology for the Base of the Pyramid: Innovative business models in education, health, agriculture and financial services.

Chandra, S., and **Patkar**, V. (**2007**). ICTS: A catalyst for enriching the learning process and library services in India. The International Information & Library Review, 39(1): 1-11.

Chen, N. S., Kinshuk, Wei, C. W., and Liu, C. C. (**2011**). Effects of matching teaching strategy to thinking style on learner's quality of reflection in an online learning environment. Computers and Education, 56(1): 53-64.

Condie, R., and **Munroe**, B. (**2007**). The impact of ICT in schools a landscape review. London: Becta Research.

Cross, M., and **Adam**, F. (**2007**). ICT policies and strategies in higher education in South Africa: National and institutional pathways. Higher Education Policy, 20(1): 73-95.

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.

Ethiopian Ministry of Capacity Building (EMCB, **2005**). National ICT

for Development 5 years Action Plan for the year 2006 – 2010.

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

Evers, H. (**2003**). Transition towards a knowledge society: Malaysia and Indonesia in Comparative Perspective. Comparative Sociology, 2(1): 355-373.

Federal Democratic Republic of Ethiopia (**FDRE**, **2010**). Growth and transformation plan 2011-2015. Retrieved April, 28, 2015 http://www.ethiopians.com/Ethiopia_GTP_2015.pdf.

Feller, G. (**2005**). ICT Policy of Ethiopia: changing positively. Information for Development (I4D), 13(6): 28-29.

Gaible, E. (**2007**). Critical review and survey of ICT in education in the Caribbean. Washington, DC: *info*Dev/World Bank.

Haddad, W. (**2007**). ICT in education toolkit for policymakers, planners and practitioners (version 2.0). Washington, DC: *info*Dev/World Bank; Paris: Unesco.

Hare, H. (**2007**). ICT in Education in Ethiopia. Retrieved April, 21, 2015 from http://www.infodev.org/en/Document.402.pdf.

Hennessy, S., Deaney, R., and 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, 2014 from http://portal.acm.org/citation.cfm?id=857119.

Kifle, M., Payton, F. C., Mbarika, V., and Meso, P. (**2010**). Transfer and adoption of advanced information technology solutions in resource-poor environments: the case of telemedicine systems adoption in Ethiopia. Telemedicine and e-Health, 16: 327-343.

Kozma, R. (**2005**). National policies that connect ICT-based education reform to economic and social development. Human Technology, 1(2): 117–156.

Kozma, R. (**2008**). Qualitative case studies of innovative pedagogical practices using ICT. Journal of Computer Assisted Learning, 18: 387-394.

Kozma, R. B. (**2002**). Technology, innovation and educational change: a global perspective. Eugene, OR: ISTE Publ.

Krumsvik, R. (**2009**). Learning in the network society and the digitized school. New York: Nova Science Publishers.

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., and Toyama, K. (**2008**). Information and communication technologies for development: The bottom of the pyramid model in practice. Information Society, 24(2): 93-104.

Levina, N. (**2005**). Collaborating on multiparty information systems development projects: A collective reflection-in-action view. Information Systems Research, 16(2): 109-130.

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.

Mehta, S., and **Kalra**, M. (**2006**). ICTs: A bridge for social equity and sustainable development in India. The International Information and Library Review, 38(3): 147-160.

Mooij, T. (**2007**). Design of educational and ICT conditions to integrate differences in learning: Contextual learning theory and a first transformation step in early education. Computers in Human Behavior, 23(3): 1499-1530.

Newhouse, P. (**2002**). The Impact of ICT on Learning and Teaching. A literature review by Dr. C. Paul Newhouse for the Western Australian Department of Education.

Ozdemir, Z. D., and **Abrevaya**, J. (**2007**). Adoption of technology-mediated distance education: A longitudinal analysis. Information and Management, 44(5): 467-479.

Plomp, T, Pelgrum, W. J., and Law, N. (**2007**). SITES2006—International comparative survey of pedagogical practices and ICT in education. Education and Information Technologies, 12(2): 83-92.

Trucano, M. (**2007**). ICT components in World Bank education projects (2001–04). Washington, DC: *info*Dev/World Bank. Routledge.

UN (**2015**). The Sustainable Development Goals of the Post-2015 Agenda: Comments on the OWG and SDSN Proposals. Markus Loewe / Nicole Rippin (eds.)

UNESCO-UIS (**2015**). Information and communication technology (ICT) in Education in Sub-Saharan Africa: a comparative analysis of basic e-readiness in schools: UNESCO institute for statistics.

United Nations' Global Development Network (**UNDP**, **2012**). Promoting ICT based agricultural knowledge management to increase production and productivity of smallholder farmers in Ethiopia.

USAID (**2012**). Ethiopia Country Development Cooperation Strategy in ICT 2011-2015.

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