CHAPTER TWO: REVIEW OF RELATED LITERATURES

Introduction

Of the four major techniques of reviewing of the related literatures viz: exhaustive review, exhaustive with selective review, representative sample article reviewing, and purposive sampling of reviews (Randolph, 2009); exhaustive with selective citation/review technique was adopted in reviewing of the related literatures for this study. This approach was preferred to other techniques because it selectively focuses only on those articles or reviews that are most related to the study. Randolph (2009) argues that finding every piece of research articles could take more time than is available. The key to the exhaustive review is to define the population (the articles/documents to be reviewed) in such a way that it is bounded and the number of articles/documents to review is manageable. Accordingly, this study encompasses reviews of related literatures which are selectively and thoroughly reviewed. Different sources of information (both published and unpublished, electronic and print materials) such as journals, magazines, proceedings, reports, books and theses/dissertations were reviewed to explore ways, find gaps, augment and develop the present study. Sometimes, literature reviews found very relevant and crucial were repeatedly referred. Occasionally, few old literature reviews were purposively used (such as in comparisons and other coercive conditions). Again, few literatures without dates (year) are cited and denoted as ‘nd’. However, their websites are duly mentioned in the Bibliography. APA and AU’s formats were used in developing this thesis. Ideas taken from other sources are paraphrased and whenever required directly quoted in block citations and quote marks. Alternative names are represented by square brackets or [ ]. Sometimes, forward slashes (/) are used to mean ‘or’. Furthermore, personal experiences of the researcher were utilized to enrich the thesis. Lastly, the concepts of reviewed literatures flow from general to specific.
2.1. Ethiopian Education and Training Policy

The success of the national effort for sustainable economic development critically depends on the quality and quantity of the available trained manpower and the awareness of the general public (ESTA, 2006). Undeniably, education will be a tool to produce manpower of required quality and quantity. Nelson Mandela (former leader of South Africa) once said, “Education is the most powerful weapon which we can use in order to prepare our youth in their role as leaders of tomorrow” (Bartz, 1990, cited in Aucoin and Learning, 2011). Besides, FDRE (1994) described education as a process by which man transmits his experiences, new findings, and values accumulated over the years in his struggle for survival and development through generations. Furthermore, Damodharan and Rengarajan (nd) described education as a light that shows the mankind the right direction to surge. According to him, the purpose of education is not just making a student literate but adding rationale thinking, knowledgeablity and self-sufficiency.

FDRE (2004) declared that Ethiopian nation recognized the value of education as an essential component for all-rounded development of the society. However, it highlighted that for education to play that role, it should be of the highest quality and relevance to the development needs.

In view of the above assumptions, FDRE (2004) formulated the 1994 Education and training policy that envisages: "Bringing up citizens endowed with a human outlook, country wide responsibility and democratic values having developed the necessary productive, creative and appreciative capacity in order to participate fruitfully in development and the utilization of resources and environment at large".

The importance the Government of Ethiopia placed on education for national development is evident from the urgency with which the transitional government adopted the Education and Training Policy in 1994. This document outlined the mission and visions for the goals the
education system of Ethiopia to achieve the national economic and social development goals (Hare, 2007).

Recent reforms in education began with the FDRE’s document, *Education and Training Policy* (FDRE, 1994). This document began with describing major problems of the educational system of Ethiopia. These include: problems of relevance, quality, accessibility, equity, mode of delivery, inadequate facilities, insufficiently trained teachers, and shortages of books and other teaching materials. In response to these challenges, attain the MDGs and achieve the six packages of education (i.e. Teachers’ capacity building, Curriculum, Quality of education, Learning materials, Civic and ethical education improvement, and Utilization of ICT in the education sector), the FDRE (2009) has set general objectives to gear to those ends. These general Objectives of Ethiopian *Education and training policy* are depicted in the next section.

### 2.1.1. Ethiopian Education and Training Policy Objectives

The Ethiopian education and training policy objectives are meant to:

i. Develop the physical and mental potential and the problem-solving capacity of individuals by expanding education.

ii. Bring up citizens who can take care of and utilize resources wisely, who are trained in various skills, by raising the private and social benefits of education.

iii. Bring up citizens who respect human rights, stand for the well-being of people, as well as for equality, justice and peace, endowed with democratic culture and discipline.

iv. Bring up citizen who differentiate harmful practices from useful ones, who seek and stand for truth, appreciate aesthetics and show positive attitude towards the development and dissemination of science and technology in society.
v. Cultivate the cognitive, creative, productive and appreciative potential of citizens by appropriately relating education to environment and societal needs (MOE, 2009).

2.2. Ethiopian ICT policy

“ICT is no luxury, but rather a crucial weapon to fight poverty”, says, Melese Zenawi (late), FDRE Prime Minister (cited in Cross, 2005). Furthermore, Genet Zewdie (the ex-education minister of Ethiopia) says, “There is no alternative to e-learning. ICT is expensive, but ignorance is more expensive.”(Ibid).

Sourced in World Factbook (2007), and as elaborated by Hare (2007), the implementation strategy of ICT in education and its corresponding action plan are components of a wider Ethiopian national e-education initiative. This initiative forms one of the pillars of the ICT for Development (ICT4D) 2010. The strategy is built on three main streams:

- Ethiopian National SchoolNet Initiative, which also includes Plasma TV project
- The National ICTs in Higher Education Initiative
- The National ICT Education, Training and Awareness Initiative

These three streams form the basis for the implementation of the strategy across the education sector. The National SchoolNet initiative, for instance, is aimed at the deployment and the exploitation of ICTs to facilitate the teaching and learning process within primary, secondary, technical and vocational schools.

Both the national ICT4D 2010 plan and the ICT in education implementations strategy recognize ICT as an enabler for widening access to education for the Ethiopian population, for supporting literacy education, and for facilitating educational delivery and training at all levels.
2.2.1. Ethiopian ICT policy: Its Vision, Mission, Goals and Objectives

To realize the ICT policy and strategies drafted, the Ethiopian ICT policy has its mission, vision, goals and objectives. Accordingly, the vision, mission, goal and objectives of the policy are depicted below (FDRE, 2009).

The vision of the policy is to improve the social and economic well being of the peoples of Ethiopia through the exploitation of the opportunities created by ICT for achieving rapid and sustainable socio-economic development, and for sustaining a robust democratic system and good governance.

The mission of the policy is to develop/transform Ethiopia into a socially progressive and prosperous nation with a globally competitive, modern, dynamic and robust economy through the development, deployment and exploitation of ICT within the economy and the society at large.

Taking into consideration the vision and mission stated above, 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:

- Develop ICT as a globally competitive industry, and as an engine of growth.
- Create the necessary conditions for the rapid development of ICT within the economy and society to accelerate Ethiopia’s socio-economic development process.
- Promote and facilitate an extensive use of ICT in support of key sectors of the economy including agriculture, industry and the services sectors.
• Transform Ethiopia into a knowledge- and information-based society and economy.
• 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.
• To ensure increased access to educational, scientific and development resources for areas and sectors of the population which have not been able to take advantage of the benefits of ICT.

Specifically, the Ethiopian Educational ICT Center (EEICTC), as a sub-sector of MOE, has its own vision, mission and goals to use ICT in Education. The vision is to see all citizens receiving quality and standardized education at any time and place. The mission is producing high quality TV, radio and e-learning programmes and transmitting them through audiocassettes, CDs, DVDs, broadcasts and satellites. Lastly, the goal is to provide quality and standardized education to citizens at any time and place by using quality educational broadcasting media.

2.3. Instructional Technology (IT)

2.3.1. The Concept of IT

This section is mainly devoted to the presentation of concepts of IT in the context of education – teaching and learning processes as reviewed by different literatures.

IT, in terms of terminology and structural composition, encompasses two fundamental terms, viz: instruction and technology. It is the media born of the communications revolution which can be used for instructional purposes alongside the teacher, textbook, and blackboard. It a systematic way of designing, carrying out, and evaluating the total process of learning and teaching in terms of specific objectives, based on research in human learning and communications, and employing a combination of human and non-human resources to
bring about more effective instructions (Commission on Instructional Technology, 1970, in Earle, 2002). Similar conceptions were also made by Heinich et al., (1993); Reiser and Ely (1997, cited in Nicolle, 2005); and AECT (1977 in Earle, 2002).

Kulik (2003) in his evaluative study of IT usage in schools remarked that schools have been more successful in using IT during the past decade than they were in earlier years. Furthermore, educationists are of the opinion that the educational problems relating to quantity and quality could be tackled by the proper utilization of ITs. IT makes instruction more effective, understandable and meaningful (Gillani, 2005). Correspondingly, Mhlolo (2007), Yusuf (2005), Kulik and Kulik (1991), cited in Aladejana (2008), noticed that proper use of IT has been identified as playing a critical role in curriculum implementation and enhancing the process of teaching and learning. Yet again, Nicolle (2005) claimed that IT is fundamentally aimed at improving the efficiency of the educational system by increasing the rate, depth, precision, and value of the learning that takes place.

The following section in detail deals with the part that IT can play in improving students’ learning and achievement, including its role in ascertaining educational quality, relevance, access and equity.

2.3.2. The Role of IT integration in the Teaching-Learning processes

It is a time-tested truth that the effective utilization of IT in classrooms significantly helps students’ learning, retention and hence improves their achievements. ITs also assist teachers. Earle (1992, in Earle, 2002) in one of his studies declared his belief when he states: “IT does, indeed, hold a remarkable promise for changing the quality of teaching and learning in schools”. And he described IT as the catalyst for transformation.
In connection to this, research evidences (e.g., Baylor and Ritchie, 2002), cited in Abdo and Semela (2010) show that teachers’ use of instructional media sustain students’ attention, increase the meaningfulness of abstract concepts, encourage deep processing, and boosts class performance through increased content acquisition. In a study: “Meta-analysis of the value and use of technology in K–12 education”, in the North Central Regional Laboratory (in Utah), Valdez et al. (2000), in Earle (2002), observed a very strong connection between appropriate teachers’ use of IT and increased student achievement.

Furthermore, a review of research studies and reports compiled in the early years of the past decade (such Sivin-Kachala and Bialo, 1995) reveal the value of technology in enhancing students’ achievement, improving their attitudes about themselves and about learning, and changing the learning environment. As pointed out by Cassidy (1982), IT is concerned with improving the effectiveness and efficiency of learning in educational contexts, regardless of the nature or substance of learning. He further explained that solutions to instructional problems might entail social as well as machine technologies.

Smith (1997) contended that the addition of technology (into a face-to-face traditional learning) modifies face-to-face learning, supports and places the learner at the center of a process that removes the confines of the traditional classroom through access to information, interactions with peers and experts, and opportunities for simulated and real experiences. This concept is consistent with what Tiene and Luft (2001), in Earle (2002), stated as: “Working in an appropriately designed technology-rich environment has the potential of producing a variety of positive outcomes: improved patterns of social interaction, changes in teaching styles, more effective teaching, increased student (and perhaps, the teacher) motivation, and enhanced student learning.”

Several studies (such as Neo, 2007; Rakes, Fields, and Cox 2006; Sandholtz, Ringstaff, and Dwyer 1997), cited in Abdo and Semela (2010)
have exposed that integration of IT in school curriculum is believed to bolster the quality of instruction via fostering student-centered pedagogies. In relation to this, Earle (2002) commented that technologies must be pedagogically sound. According to him, ITs must go beyond information retrieval to problem solving; allow new instructional and learning experiences not possible without them; promote deep processing of ideas; increase student interaction with subject matter; promote faculty and student enthusiasm for teaching and learning; and free up time for quality classroom interaction - in sum, improve the pedagogy.

What is more, MOE (2004) in its document: *Guidelines on the Usage of Satellite Educational TV Programs* holds the belief that ICT aided educational provisions open a wide opportunity for students to compete for international accomplishments and emphasizes that the use of ICT in schools enhances students' self-directed learning opportunity and their confidence as citizens. The other belief is that education through ICT enables students to get access to the international spectra of hobbies and fields of interest. Again, the government (FDRE) sees ICT as a panacea to the entire social, political, educational, cultural and economic conundrums the country has long been submerged in.

Duffield (1997 in Earle, 2002) warns us to remember that technology is not a subject, rather the focus of IT integration should be on pedagogy — effective practices for teaching and learning. According to him, technology integration is not about technology—it is primarily about content and effective instructional practices. He further highlighted that technology merely involves the tools with which we deliver content and implement practices in better ways. Its focus must be on curriculum and learning. He concluded that integration is not measured by the amount or type of technology used, but by how and why it is used. This corroborates the findings of a study by Bernauer (1995) in which he highlighted that it is not technology per se that results in improved
student outcomes, but rather how the technology is used and integrated into instructional processes.

The real purpose of integrating IT into classroom teaching should be to make the teaching-learning process ‘whole’, i.e. to equip/supplement the learning environment with resources which can’t be made available by the classroom teacher. The simultaneous presence of the human element (the teacher) plus the non-human element (IT) help students learn better than they learn by either of the two elements alone. Corroborating this idea, Earle (2002) referred to the very meaning of the term ‘Integration’ (integration: from the Latin integrare, to make whole) and it includes a sense of completeness or wholeness and incorporates the need to overcome artificial separations by bringing together all essential elements in the teaching and learning process—including technology (as one of the elements, not the sole element).

IT should be understood as an auxiliary tool in enriching learning. It is not a surrogate teacher. It is not per se a panacea to all the problems linked to education. There are research findings which support the idea that ITs are not the sole remedy to problems that arise in the milieu of teaching and learning. One such finding was reported by Taylor (2000) in which he stated, “Technology is not the ‘silver bullet’ that will solve all of our education problems, but it is certainly a useful tool that enables us to link various learning communities together in new and different ways”. It is not about what technology by itself can do, but what teachers and learners may be able to accomplish using these tools. Also Tucker (1992) in one of his studies stated “...although many of us strongly believe in the great promise that technology holds for both learners and teachers, we also need to remember that, first and foremost, technology is a communication tool”. Lastly, Snider (1992) reminds us that focusing exclusively on technology as a panacea for improving schools has been somewhat fruitless across decades of technological innovations.
2.3.3. The Pedagogical Basis and Implications of IT Integration in Education

This section briefly discusses about the pedagogical significances of ITs, i.e. how ITs positively affect students’ motivation to learning, retention of the content learned and improve their achievements.

There are several qualities and mechanism of ITs that made them pedagogically preferable in improving students’ learning and their achievements. Some of these qualities include their being audio-visual media (such as Plasma TVs), ability to present lessons in animations, especially in 3Ds (three dimensional displays), simulations; bringing 'real world' into the classroom, multicolored demonstrations of different Biological bodies like various macro-level organs (such as brain, heart, lungs, kidneys,...) and micro-level entities such as Cells and Chromosomes (DNAs, RNAs) and so forth. The range of mechanisms that ITs employ to improve students’ learning and hence their performance and achievements comprise attraction and retention of their (students’) attention in learning (i.e. elongate attention span), create interest and motivation, engagement, generate creative and critical thinking, and others. Carefully designed or chosen instructional media have the great potential of fighting against boredom. Thus, ITs “enliven” classroom lessons by the qualities and mechanism highlighted above.

In connection to this, different literature reviews (such as Wiken, et al, 2005; US Department of Education, 1995; Lumley, 1991; Lewis, 2004; McCombs, 2000; Dunlap, 2002; Wang and Woo, 2007; Boster, 2004) reveal that the effective integration of ITs have positive impacts on the students’ motivation, interest and engagement in learning and boost up their retention of the contents learnt and improve their achievements. Especially, Wiken, et al (2005) emphasized that technology improves motivation, engagement and interest when students use multimedia and using audio and video technologies brings content to life and stimulates

The above discussions can be recapped by using Edgar Dale’s Cone of experience (Figure 2) which illustrates Audio-Visual Methods in Teaching (Dale, 1969). It is self explanatory from Figure 2 below that one can remember 50% of what he/she learnt through audio and visual methods. Though this figure (percentage) is half-way, it is still better than learning a content in either methods alone. “Saying/talking” and “doing accompanied by saying” constitutes the largest proportion (70% and 90% respectively) of remembering/retention of the contents learned. The implication is that if students are exposed to audio-visual followed by learning by doing (e.g. Biology lab practicals, including presentations and discussions of/on Biological concepts, field works), the best learning environment is created, and thus effective learning can take place.

Figure 2. Edgar Dale’s Cone of Audio-Visual Methods in Teaching (Dale, 1969).
Media at the top of the cone are said to be more passive but are suitable for transmitting large amounts of information quickly and are best depending upon purposes and circumstances. For instance, Kopp (1982, in Roussell, 1996), identifies visuals as being an effective use in motivating learners. According to him, visuals must be effective for the learner in three distinct ways. Viz: (i) Enable the learner to make the invisible visible. (ii) Provide structure to complex content and (iii) Are dramatic.

A study conducted by Boster et al. (2002) on teachers’ beliefs about the effects of use of multimedia in a classroom shown that it greatly increase interest, attention and curiosity of the students. In the same study, teachers also revealed their beliefs that, the increase in attention leads to increased retention and motivation, which ultimately leads to better learning and improvement in the students’ achievements.

Similarly, classroom experimental studies were conducted on the effects of streaming video (unitedstreaming) in the learning of students (in USA) and the outcome of the study suggested that the application of videos have improved the educational performance of students (video groups) as compared to their counter groups (non-video groups).

2.3.4. Issues to be considered in integrating IT in Education

This part briefly presents the various issues that ought to be cautiously considered before integration (planning phase), during integration (implementation phase) and after the integration (evaluation phase) of IT into classroom teaching-learning practices. Here, ‘issues’ refer to factors that either affirmatively or negatively affect the successful integration of ITs into the classroom teaching-learning activities. Furthermore, it should be noted that there are some issues that are common to the three phases of IT integration and hence, they can appear more than once in the various phases of IT integration. What is more, the issues depicted
below are based on the reviews and personal experiences of the researcher. However, the explanations presented are not exhaustive as the issues in the successful integration of IT into a teaching-learning process are intertwined and multidimensional in nature. Thus, only those points relevant to the present study are highlighted.

2.3.4.1. Planning Phase

The major issues that should be considered and accomplished ahead of integration (planning phase) of ITs into the classroom teaching-learning practices should include: (i). Clear national IT integration policy, (ii). Firm political commitment by the government, (iii). Identifying the need for and relevance of IT integration, (iv). Formulating clear vision, mission, values and objectives of IT integration, (v). Designing strategies of IT implementation, (vi). Producing guidelines and manuals on IT policy, its integration, roles and responsibilities of the stakeholders, (vii). Securing willingness and active participation of the staffs, (viii). Working out awareness creation to school stakeholders (especially to teachers and students) and building capacity of staffs on IT integration skills (such as through professional development (PD) programmes: in-service training programmes (including inductions) on a continuous basis), (xi). Ensuring access, relevance, equity and quality of IT-based/enhanced educational system, (x). Making available the required IT tools/infrastructure in a needed quantity and quality, (xi). Devising the reliable source of power (electricity), (xii). Employing and empowering technical assistants (technicians), (xiii). Working out cost and source of fund, (xiv). Ascertaining the sustainability and feasibility of the IT, (xv). Assuring regular support and steadfast commitment from the administrators of the school, districts and other concerned bodies.

As can be understood from the foregoing explanations, productive integration of IT into classroom teaching-learning practices involves multidimensional and interdependent issues that need to be
systematically planned, organized and put into practice. In connection to this, different studies (such as Jhurree, 2005; Nkom, 2008; Levine, 1998; UNESCO, 2004; CPB, 2004) have called attention to the in advance and careful planning of ICT integration in education. Particularly, Jhurree (2005) stressed that the successful integration of ITs into classroom warrants careful planning and depends largely on how well policy makers understand and appreciate the dynamics of such integration. In addition to that, UNESCO (2004) believes that a well-planned and responsive education system provides an appropriate enabling environment for the successful implementation of IT in education policy and programme.

2.3.4.2. Implementation Phase

Like the planning phase, there are crucial issues that must be given due emphasis while the ‘implementation phase’ of IT integration. Some of these issues encompass: (i). Making sure that the IT-based education is accessible to all learners at all the corners of a nation through different broad and narrowcast media (such as TV, radio, and so on), (ii). Making IT-based education equitable to all irrespective of the socio-cultural and socio-economic status of the learners, (iii). Providing PD trainings to teachers on continuous basis to guarantee the productive utilization/integration of IT; and the like. In line with this, Wiken, et al (2005) remarked that technology by itself can’t improve students’ learning. However, how the classroom teacher utilizes IT to implement the curriculum matters most.

2.3.4.3. Evaluation Phase

The evaluation phase of IT integration mainly targets on the appraisal of the IT-based/enhanced educational system. During this phase, the total performance of the school will be checked vs. the vision, mission, values and objectives stipulated in the planning phase of IT integration. Hence, based on the feedback obtained or findings of the evaluation, necessary
measures (such as modifications, changes, rejection or maintaining of the status quo) will take place. In other words, SWOT analysis should be done to identify the weaknesses, strengths, opportunities and challenges.

In relation to the above conceptions, various studies (such as Wagner, et al., 2005; UNESCO, 2004; Bullock and Ory, 2000; Jackson, 1990; Tondeur, 2007) highlighted on the importance of an incessant evaluation of ICT-based/enhanced education for its effectiveness. Among these, UNESCO (2004) stressed that evaluation of IT in education programme should be a continuous process, covering planning, implementation, reflection, refinement, effectiveness and user acceptance. Furthermore, UNESCO (2004) urged that carrying out a SWOT analysis and applying its findings help to optimize use of ICT resources.

In sum, there are manifold interplaying issues that must be taken into consideration in IT integration. The aforesaid phases are interlinked, and feedback from one phase (especially from the evaluation phase) can be used by the next phase in a continuous fashion to make the process more effective. Figure 3 below depicts relationships between the above three phases.

Figure 3. Relationships between the three phases of ICT integration in education.

IT planning Phase ——> IT implementation Phase ——> IT evaluation phase
Feedback ——> Feedback

In the following sections, the concept of educational broadcasting, Television (TV) and its educational values are briefly presented against the existing reviews of the related literatures.

2.4. Broadcasting

Broadcasting is a term that refers to the distribution of audio and video content to a dispersed audiences via any audio or audio-visual medium
“Broadcasting”, nd). The term broadcasting is also used to mean: to transmit or make public by means of radio or television (“Broadcasting”, 2012).

There are several types of electronic media broadcasting. However, all these are not discussed here; rather TV broadcasting is highlighted in the upcoming sections as it is the focus of the present study.

2.4.1. Educational Broadcasting

Educational broadcasting refers to TV and radio programming providing or related to courses of study (“Broadcasting”, nd). It refers to any broadcasting of specific subject materials can be education but educational broadcasting is generally held to be radio and TV airing of delineated formal educational material. Here TV broadcasting is focused.

2.4.2. Television (TV)

The word Television is a hybrid word, derived from both Greek and Latin. "Tele-" is Greek for "far", while "-vision" is from the Latin "visio", meaning "vision" or "sight". TV is a telecommunication system for broadcasting and receiving moving pictures and sound over a distance. The term has come to refer to all the aspects of TV programming and transmission as well. It is an audio-visual media that combines both audio and visual media.

2.4.2.1. Educational Values of TV

TV has many educational values. Researchers and educators have recognized the need for attention getting devices (such as TV) in the classroom. Such devices, in addition to providing information in a more entertaining (edutainment) format which leads to an enjoyable classroom setting, studies have indicated that there is a direct relationship between attention and achievement in an educational setting (Brofenbrenner,
1976 and Gagne, 1985, in Roussell, 1996). Such devices include audio-visual media such as TVs.

We all might have heard the saying: “Seeing is believing.” Studies have also shown that seeing is remembering, too. People generally remember about twice as much when they see and hear something (audio-visual), than when they only see or hear it (CPB, 2004). In connection to this, Kozma (1991) stated that TV’s combination of sound and imagery renders it a powerful aid to learning. A review of research by Wetzel, et al., (1994, cited in CPB, 2004) shows that adding sound to still pictures results in greater learning than merely adding motion. That is, the combination of sound and either still or moving images is more effective than just making still images move. They added that TV’s combination of multiple symbol systems - that is, its mix of spoken language, text, still images, and moving images - yields greater learning gains than media that rely primarily on one symbol system (Figure 2).

Other literatures (such as Roussell, 1996; Kozma, 1991; George, 1989; CPB, 2004) similarly underlined in the audio-visual aspects of TV by which it [TV] affects learners’ motivation and interest. In Particular, CPB (2004) claimed that one of TV’s most obvious characteristics is its visual aspect. Humans intuitively grasp the power of images to convey meaning, as can be seen in the old adage that values a picture at a thousand times the value of a word. CPB further elaborated that TV, of course, offers information in multiple forms: not just images, but motion, sounds, and, at times, text.

Researches as well have shown that multiple tracks of audio and visual information convey powerful learning benefits, as each source complements the other. Kopp (1982, in Roussell, 1996), identifies visuals as being an effective use in motivating learners. According to him, visuals must be effective for the learner in three distinct ways. Viz: (i). Enable the learner to make the invisible visible. (ii). Provide structure to complex content and, (iii). Are dramatic. A study by Skolnik and Smith (1993,
cited in Hendry, 2001) also reveals that TV is an excellent medium for illustrating applications, describing context, and generating interest. Hence, emphasizing on the visual learning, Haynes (1989, in Roussell, 1996) said that one of the major developments identified in instructional media has centered on the visual presentation of learning materials through the use of TVs in the classroom.

As studies in theories of learning (such as cognitive, brain-based and other) show that lessons learned through audio-visual media are more easily recalled than lessons learned through mere words. In relation to this, researches in the past two decades have proven what we intuitively know i.e. our brains deal with images differently than print. In this regard, the analytic views made by Noble (1983) and Bergsma (2002), cited in CPB (2004), are presented as follows. According to Bergsma (2002), words are processed in the brain (neocortex) where the higher thinking capability of the brain resides, whereas according to Noble’s (1983) view, pictures are handled in the limbic system, rapidly, and trigger instinct, emotion, and impulse. Because brains are programmed to remember experiences that have an emotional component, TV has a powerful ability to relay experience through the emotions evoked by images.

In general, the educational value of the planned TV programmes may be summarized as follows (Mangal and Mangal, 2009).

i. TV instructions have the potentiality of improving the process and products of learning as they involve thorough planning, systematic presentation and integration of a wide range of audio-visual material and appliances.

ii. TV programmes prove helpful in upgrading the curriculum and enriching the educational programme more easily and economically.
iii. TV, as an educational device, may offer some solution for the problems of shortage in education such as shortage of good teachers, classrooms, audio-visual aids and other resources.

iv. TV may be helpful for a teacher in his personal growth. He may learn the skill and art of his profession by observing the TV programmes.

v. TV can bring models of excellence to the students. They can view and hear the work and talk of eminent educationists, renowned teachers, creative scientists and excellent demonstrators, musicians or artists. Their presence on the TV screen may provide them due warmth and nearness for drawing maximum educational and psychological advantages.

vi. TV can display the world of reality in the classroom through its screen, very often quite inaccessible, impossible or expensive to the students.

vii. TV helps the teacher as well as students in the realization of teaching-learning objectives. It is an economical device that helps in saving the time of both the teacher and students.

viii. TV instructions may bring greater equality of opportunities for all pupils. The peoples studying in remote rural or underprivileged areas may be equally benefited by the TV programmes.

ix. TV, in the form of educational media, may help in making school as a center for community welfare and education.

Similarly, in other studies, such as Hizal (1983) and Walker (1995), cited in Vyas, Sharma and Kumar (2002); and Nkom (2008) suggested lists of educational values of TV that go in line with the accounts given by Mangal and Mangal (2009) above.
2.4.2.2. Strategies for the Effective Utilization of TV in the classroom

All instructional technologies (ITs), Plasma Television (PTV) among them, require planned, targeted, cautious and pedagogic utilization to gain the expected benefits from them i.e. strategies on how to productively use these ITs must be devised. If these technologies are not properly utilized, the adverse effects may outweigh the desired outcomes. Therefore, designers as well as teachers need to have clear concepts, understandings and expertise on why, how and when to use them. In connection to this, Barnes (2001), Fisch (2004) and Rogow (1997), cited in CPB (2004), in their study, How Might Teachers Enhance the Learning Value of TV?, produced a list of strategies or recommendations (for educators/teachers) to be used while integrating TV in their classroom lessons. However, they remarked that the lists are in no way intended to be comprehensive or definitive, but instead should be seen as a springboard for further innovation. According to these recommendations, educators/teachers are expected to:

- Plan Ahead: This also requires the educator to:
  - Spark interest on or inspire students.
  - Demonstrate something he/she can’t do any other way.
  - Enrich curricular content.
  - Practice a skill.
  - Reinforce or review a topic.
- Promote active viewing and interaction. Interactive viewing requires three simple steps:
  - Prepare:
    - Previewing the program to be sure it meshes with teaching approach and class learning goals.
    - Determining the setting and length of the TV/video.
• Setting clear expectations from the students — precisely stating what the educator want them [students] to gain from viewing the program and what follow up activities will take place.

• Practicing with the equipment and cuing up the relevant portions the educator will be viewing.

• Participate. This supposes the educator:

  • Not to turn off the lights/power.
  • To preface the viewing with a few key questions and/or learning objectives.
  • To use the pause button to flag to important topics, and allow for questions.
  • To turn on closed captioning to reinforce narrated information.
  • To consider a second viewing — especially for younger children. Alternatively, in some cases, TV video tapes might be circulated for home viewing.
  • To break students into small groups for discussion, and/or have them write down their thoughts, then share the results with the larger group.

• Connect. This requires the educator to:

  • Choose follow up activities that connect to hands-on or real-world experience
  • Explain the connections the educator makes, especially for early grade students

Similarly, Clovis (1997) identifies the following strategies of using TV/video in the classroom. These strategies are based on her practical classroom experiences of English language teaching. The strategies include:

• Pausing the video so students could copy down visual information;
• Eliminating the sound track so students could practice their oral and written English skills by supplying the missing dialogue;
• Using closed caption programs to reinforce vocabulary and reading skills; and
• Providing copies of video tapes to students and their parents too, so that they (parents) can improve their English and become “active partners” with their children in the learning of English.

In another study, *Effective Strategies for Using Instructional TV*, Barnes (2001); Fisch (2004); Rogow (1997, cited in CPB, 2004), have also developed similar strategies for the effective utilization of TV. The main themes of the strategies were: previewing the program; selecting segment(s) of program; preparing classroom for viewing; providing a focus for viewing; during the lesson, pausing narration for interactions and entertaining of any hesitations that may be raised by students; and after the TV/video lesson is over, reinforcing the learning experience with hands on activities.

It should be noted that the strategies or procedures presented above work when the classroom teachers have full autonomy and control over the broadcast/TV programmes. If the broadcast is directly transmitted or streamed from a single source (center) to all schools (e.g. Ethiopian secondary schools), teachers will not have autonomy and control over the broadcast. As a result of that, teachers as well as students will not have the power to control or modify the pace of broadcast and time allotted for each activity. These arguments are in line with the findings of studies such as Hussein (2006); Tessema (2006); Bitew (2008); and CPB (2004). Furthermore, in a classroom where the TV broadcast is unidirectional and uncontrollable, there will be limited interaction between a classroom teacher and students. Still teachers and students may not know what will be transmitted through TV unless otherwise they are preinformed. What they [teachers and students] all
can do is that they must comply with the schedules set by the broadcasting centre. In such a situation, classrooms are made to adapt to the broadcast instead of adapting the broadcast to fit the classroom situations. This is the typical case in countries like Ethiopia where the educational broadcast by PTV is centrally manipulated and classrooms environments are coercely made to fit the PTV lesson broadcast.

2.4.2.3. Criteria of Highly Educational TV Programme

TV programmes, to meet the educational and edutainment needs and interests of the learners, must be of high quality in terms of content, clarity, delivery, applicability, relevance/importance, interactivity, gripping, and so on. At this juncture, Judging Children’s Educational TV (2009) identifies six criteria of highly educational TV programme as discussed below.

2.4.2.3.1. Clarity

This relates to how easily can learners identify the primary lesson. A lesson with good clarity is easy to understand, straightforward and obvious, whereas a lesson with poor clarity is difficult to identify and may be hidden by distractions, unclear dialogue or other subplots within the episode.

2.4.2.3.2. Integration

This is associated with question “how often do learners hear or see the primary lesson?” A lesson with good integration is repeated or demonstrated multiple times throughout the episode. A lesson with poor integration is separated from other program content and may not seem related to the main plot or storyline.
2.4.2.3.3. Involvement

This is concerned with how engaging and interesting is the lesson for the viewer. An episode with good lesson involvement makes a strong and consistent effort to get the viewer’s attention. Some techniques can increase involvement, such as speaking directly to the viewer, tying the lesson to emotionally involving content and/or using popular characters. An episode with poor involvement doesn’t engage the viewer in the primary lesson.

2.4.2.3.4. Applicability

This relates to the question “Is the primary lesson connected to the real world?” An episode with good applicability shows how the primary lesson relates to the everyday experiences of a typical child. Conversely, an episode with poor lesson applicability doesn’t demonstrate how the information is relevant to the child’s everyday world.

2.4.2.3.5. Importance

This refers to “How valuable or useful is the primary lesson to the viewer?” A lesson that is high in importance is one that is crucial for a child to learn while a lesson that is low in importance is one that holds little utility for a child’s development.

2.4.2.3.6. Positive Reinforcement

This refers to rewarding of efforts or successful learning.

2.4.2.4. Concerns in watching TV

Despite the fact that integration of TV in education has myriads of useful benefits to students as well as teachers (as indicated in sections 2.4.2.1 and 2.4.2.5.1), sometimes lack of: (i). skills on how to watch TV lesson broadcasts, (ii). Proficiency in the language of broadcast, and (iii). Keen attention, interest and intention, perception about TV lessons and other
issues can have an awful effect in the performance and achievements of the students. These concepts/issues are interrelated and show immense interplay.

There are multitudes of findings, for example, Anderson and Lorch (1983), Huston and Wright (1983), Anderson (1983), cited in CPB (2004); Kozma (1991); Hussein (2006); Tessema (2006); and Bitew (2008) that support the idea that lack of the aforementioned aspects (skills, interests, attention, intention, language proficiency, etc) adversely affect students’ learning and their success. In particular, CPB (2004) contended that watching TV may seem a very simple act, but it actually involves a rather complicated thinking process.

According to CPB (2004), viewing is an active process, perhaps best thought of as an interactive experience between viewer and medium. Like any communication medium, the content of TV is composed of symbols (in the form of discrete units of information) and thus, our cognitive task is to decode those symbols. But with broadcast TV, the symbols are more transient, more fleeting than with static media like books or pictures. Thus, TV offers a “window of cognitive engagement.” The degree of openness of that window, according to Kozma (1991), is conditioned by the quality of interaction between viewer and the visual medium. Viewers of TV generally have less control over the flow of information than with more static media, their ability to “recall” or go back to passages that they may not have grasped the first time is more limited than with still media (Ibid).

Since viewers have limited control of the flow of information, comprehension is importantly linked to their ability to stay engaged with the medium. Researchers have accordingly devoted much attention to the subject of attention; that is, how and why viewers stay attuned to the content flow from the screen. And because TV draws on two sensory channels-audio and visual, comprehension also depends on the viewer’s
ability to simultaneously process both audio and visual tracks (Anderson, 1983 in CPB, 2004).

Researchers, for instance, Anderson and Lorch (1983), Huston and Wright (1983), cited in CPB (2004); Bitew (2008); Hussein (2006); and Tessema (2006) have studied the problems learners as well as teachers encounter during educational broadcast through TVs. Accordingly, Anderson and Lorch (1983), Huston and Wright (1983), as cited in CPB (2004), stated: “... by adjusting the pacing, sequencing, and relative priority of the two information channels-audio and visual channels, and manipulating of the program’s formal features, video producers are able to affect viewer attention, and can thereby affect the learning potential of the program.” In addition, CPB (2004) suggested that video Cassette Recorders (VCRs) and other playback technologies have obviously made the problem of pace (speed) of broadcast less of a factor. In school settings, videos are still tending to be a one-to-many broadcast. Emphasizing this, Sullivan (2008) explained the situation when he says, “If a picture is worth a thousand words,... a video depiction must be priceless!”

2.4.2.5. Advantages and Limitations of TV

Any instructional media or method has its own advantages and limitations. Correspondingly, instructional TVs (ITVs) have their own advantages (strengths) and limitations (weaknesses). In relation to this, myriads of studies (such as Anderson and Collins, 1988; Nkom, 2008; Mangal and Mangal, 2009) have been conducted. For instance, Anderson and Collins (1988) claimed that TV has been both lauded and criticized for the ways in which it presents information to the viewer, irrespective of the information itself. In particular, the advantages and limitations listed by Nkom (2008) are found to be more inclusive and relevant in the
context of the present study and hence, opted from among other literatures and briefly depicted below.

**2.4.2.5.1. Advantages of TV**

- The most obvious instructional attribute of a TV is its ability to present color moving pictures (visuals) with sound (audio) over long distances. Its signals can be recorded and played back instantly.
- Communication by TV is effective because it can transmit a wide range of audiovisual materials including still pictures, film, objects, specimens and drama.
- TV reaches large audiences at low-cost per person.
- Viewers over vast geographical areas can experience a live event simultaneously. It is capable of transporting the viewer to any location in the past, present and future.
- Learners can be reached at home through TV broadcasting which makes “open and distance learning” a reality. The development of inexpensive video-recorders makes it feasible for students to view video materials on an individual basis, at their own time and pace.
- TV can bring models of excellence to the viewer. We can see and hear the able scientists, the creative teachers, the great poets and the pragmatic dramatists. TV can also bring specialized teachers in foreign languages, mathematics, science etc to the classroom.
- TV bridges the educational opportunities gap between children living in urban centers and those in the rural communities.
- TV can bring the versatility of the TV camera to the teaching process. The medium provides us with sounds and sights not easily available even to the viewer of a real event: long shots, close ups, zoom shorts, magnification, extreme close ups, etc. For instance, medical students watch films on surgery and perform the actual surgery; and various Biological simulations and animations can also be viewed through TV.
• TV is used for self evaluation in micro-teaching in teacher training colleges, and the like.

• TV can be both instructive and enjoyable. It can provide an interesting, exciting change of pace, and give us the variety that is the spice of education. (Nkom, 2008).

2.4.2.5.2. Limitations of TV

• The complexity of the TV technology allows many possibilities for disruption of the communication flow, i.e. atmospheric conditions may disturb broadcast signals or satellite reception. This limitation can be combated using video cassettes.

• There is the possibility of technical difficulties over which the teachers or students have little or no control that will intervene between the lesson and the learner e.g., the TV set itself may be malfunctioning.

• TV as an instructional tool is a one-way channel of communication. There is little or no feedback from the target audience. Some critics of TV also advance the reason that it encourages passivity on the part of the viewer, especially for educational purposes. Live Broadcasts, however, have adopted phone-in methods to reduce the limitation.

• Cost may be another limiting factor. Colour TV sets are expensive; moreover, the human labour involved in production, distribution, maintenance etc can also be capital intensive. Unless large numbers of learners are being served, the costs may be difficult to justify.

• It is not very ideal for large group viewing since TV image is displayed on a rather small surface. One TV receiver is needed for approximately thirty viewers. Though this limitation can be overcome by using the large-screen TV projection systems, the cost is still prohibitive for many educational applications.

• TV moves ahead at a constant speed. One can’t see a TV programme as he/she would work on a book. Also one can’t read at his/her own
pace. In other words, one must match the tempo of his/her learning with the tempo of the televised presentation. This is not always a simple matter. However, some modern TV sets are equipped to either fast-forward, slow down or revival to previous experiences. (Nkom, 2008).

2.5. Educational Broadcast through Plasma Television (PTV) in Ethiopian Secondary Schools

In the upcoming sections, first, the purpose and nature of PTV integration are discussed, which then followed by the presentation of reviews of literatures related to opportunities and challenges in integrating PTV in teaching secondary school Biology in Ethiopia. To have a clear image on or grasp themes of the following sections, the nature of educational broadcast through PTV in Ethiopian secondary schools is pictorially represented hereunder in Figures 4a and 4b.

Figure 4a. Biology lesson broadcast through PTV.

Figure 4b. Biology lesson broadcast through PTV.
2.5.1. The Purpose and Nature of the Integration of PTV into the Classroom Teaching-Learning Practices

The main purpose of the integration of PTV lessons into Ethiopian secondary schools education lies in the statement made by the FDRE (1994) which reads as follows:

...to date, it is known that our country’s education is entangled with complex problems of relevance, quality, accessibility and equity. The objectives of education didn’t take cognizance of the society’s needs and didn’t adequately indicate future direction. The absence of interrelated contents and mode of presentation that can develop student’s knowledge, cognitive abilities and behavioral change by level, to adequately enrich problem-solving ability and attitude, are some of the major problems of our education system. In addition, inadequate facilities, insufficient training of teachers, overcrowded classes, shortage of books and other teaching materials, all indicate the low quality of education provided.

Furthermore, the Ethiopian National Agency for UNESCO (ENA, 2001), in its survey, *The main problems and challenges facing national education in Ethiopia at the beginning of the twenty first-century*, stated:

The teaching of natural sciences and mathematics (which are the core disciplines) remains to be another challenge given the continuous shortage and sometimes absence of appropriate kits and laboratory facilities in the schools - primary and secondary schools alike; the shift of the teaching methods from teacher-centered to learner-centered approach requiring great demand on public resources for preparation of teachers and provision of appropriate inputs as well as construction of infrastructures to reduce the existing teacher-pupils ratio to the standard set in the strategy; shortage of books and other teaching materials, all indicate the low quality of education provided in the country.
As can be realized from the above accounts, the foremost purposes for the integration of the PTV lesson broadcast was to improve the standard of secondary education in terms of its quality, quantity, relevance and accessibility. For that, MOE considered integration of ICTs (such as PTVs) in education as a ‘silver bullet’ to all the aforesaid problems. In relation to this, FDRE (2004) claimed that, with the globalization and achieving of the MDGs by 2015, it will give due emphasis to science subjects and utilizations of technologies such as ICTs as the highest panacea to gear towards that end - achieving the four frontier educational goals - quality, quantity, relevance and access.

2.5.2. PTV Lesson Production and Nature (mode) of Broadcast

The PTV lesson production was outsourced to South Africa. Accordingly, based on the agreement entered between Ethiopia and two South African joint Companies (Kagiso and Sasani limited), which specialize in high volume educational content production for primary and secondary schools, produced all the PTV lessons in accordance with the curricular and time frames specifications provided by the Government of Ethiopia. The lessons so produced have been broadcasted in almost all Ethiopian secondary schools (grade levels 9-12) since 2004 till date.

According to some evaluative studies, the project was found to be very demanding, cost intensive, and costed Ethiopian government US $80 million (Mulugeta, 2009) with each PTV coasting about $2000 to $2,500 (Kinde, 2007).

In the moment, about 3000 lessons were produced and made ready for the broadcast (Hussein, 2006). Further, these programmes were supposed to reach some 6,000 Ethiopian classrooms via digital satellite system (Evans, 2005). To implement the project, more than 2,978 PTVs were bought (Tessema, 2006). According to MOE (2010),
about 71.6% of secondary schools are equipped with PTV, yet 28.4% to be equipped.

However, because of many daunting critics from the teachers, students, parents and educational experts, this project didn’t keep on running; rather it was stopped after functioning for about six years (2004 to end of 2009). Thus, the broadcast was interrupted for a year (in 2010). However, with slight modifications on the previous broadcast (such as reducing of PTV time from 40 minutes to 20; introduction of Non-plasma [NP] periods, PTV screen sign language teachers, secondary schools installed with PTVs (Appendix VIII, A, B and C; Figures 4a and b in section 2.5), except some, restarted (in 2011) receiving educational transmissions from a broadcasting center named as EEICTC, formerly known as Educational Media Agency (EMA). The broadcast is not ‘live’; rather recorded video lessons are broadcasted through PTV to grade levels 9 -12 according to the schedule (Appendix V) set by the MOE. The brief path of PTV lesson broadcast is sketched below and diagrammatically presented in Fig. 5.

EEICTC ➔ ETC (Tele) ➔ Satellite ➔ Satellite receiving Dish ➔ Combo box (Amplifiers) ➔ Couship (Decoder) ➔ Splitter ➔ PTV

Figure 5. Pathway of PTV lesson transmission.

The detail mechanisms (technical aspects) of transmission are not presented here as they don’t serve the purpose of the present study. EEICTC supervises as well as evaluates the whole process of PTV lesson broadcast under the umbrella of MOE. The following Table shows the
subjects transmitted, time allotted for each subject, classroom and PTV teachers (Full schedule attached in Appendix V).

Table 1. Subjects Broadcasted through PTV and Time Allotted for Each Subject, Classroom and PTV Teachers.

<table>
<thead>
<tr>
<th>S/N</th>
<th>Subjects broadcasted</th>
<th>Broadcast per week</th>
<th>Time (in minutes) allotted for PTV teacher**</th>
<th>Some of the expected activities of a classroom teacher within 20 minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Biology*</td>
<td>3</td>
<td>≥ 20</td>
<td>≤ 20 Lesson presentation (such as giving short notes and explaining them)</td>
</tr>
<tr>
<td>2</td>
<td>Chemistry</td>
<td>3</td>
<td>≥ 20</td>
<td>≤ 20 Summarizing</td>
</tr>
<tr>
<td>4</td>
<td>Maths</td>
<td>5</td>
<td>≥ 20</td>
<td>≤ 20</td>
</tr>
<tr>
<td>5</td>
<td>Physics</td>
<td>3</td>
<td>≥ 20</td>
<td>≤ 20</td>
</tr>
<tr>
<td>6</td>
<td>Civic &amp; ethical edu.</td>
<td>3</td>
<td>≥ 20</td>
<td>≤ 20</td>
</tr>
</tbody>
</table>

*Focus of the present study. **All foreigners. "≥" Greater than or equal to; "≤" less than or equal to the specified time (minute). One period = 40 minutes.

Even though the actual time allotted (by MOE) for each subject to be broadcasted (by PTV) in one period is 20 minutes, usually, the broadcast goes beyond 20 minutes (≥ 20 minutes), up to 25 minutes. This obviously affects (shortens) the time the classroom teacher should utilize for his various classroom activities indicated in Table 1 above.

A sample of detail weekly schedule of PTV lesson broadcast for grades 9-12 is attached in Appendix V. This weekly time table/schedule/shows the entire contents (periods, school and PTV times, channels (Plasma as well as Non-plasma [NP]), periods per a week for a given subject and so on.

It should also be noted that the lists of subjects given in Table 1 above are not complete as there are remaining subjects that are taught in the schools but not transmitted through PTV.
2.5.3. Opportunities in Integrating PTV in Teaching Biology in Ethiopian Secondary Schools

The breadth and depth Biology deals with, its social, economic and scientific significances (not to mention others), as discussed in section 1.3, are rather more elaborated. The right learning and due understanding of the fundamental Biological concepts entail meticulous designing, judicious selection and implementation of the appropriate teaching methodologies and instructional tools.

Different studies (such as Aladejana, 2008; Meless and Teshome, 2006) reveal that the sole use of conventional lecture method is not effective in assisting students to learn the contents in the required depth, breadth and to retain and recall the information they learned to tackle their daily practical problems. The same conception is applicable to Biology. Biology is among practical sciences. A number of instructional methods, techniques and tools can be used to help students learn Biological concepts clearly and effectively. In relation to this, Li (2009) stated:

With Biology being an experiment-based branch of natural science that studies the classification, structure, function, behavior and evolution of different levels in creatures, it seems particularly important to employ a variety of teaching arts to put across different life phenomena and their basic laws in its teaching.

As different literature reviews show, most schools in Ethiopia, on one hand, are lacking the required science labs, chemicals and equipments (ENA, 2001); pedagogic centers including textbooks (MOE, 2010); Poluha (2001) and Joint Review Mission Report (JRMR, 2003), in Lasonen et.al (2005); well qualified and experienced teachers (MOE, 2010); Timely in-service trainings to teachers (such as in ICT integration expertise) and funds (MOE, 2010); and lack of student-centered and field methods of
learning. Furthermore, classrooms are highly crowded (Poluha, 2001, in Lasonen, et.al, 2005; Bitew, 2008; Semela 2003).

On the other hand, teaching Biological concepts is not an easy task as it requires well-organized labs, appropriate teaching methods and tools, and qualified teachers. Duly studying the world of life (kingdoms of life) and their anatomy, morphology, physiology, behavior, nutrition, ecology, etc obviously bring problems to students while learning, unless and otherwise their [students'] learning is supported by appropriate instructional tools such as instructional TVs, not to mention the educational values of other instructional technologies.

In this regard, PTV, which is already integrated in Ethiopian secondary schools, is believed to play a crucial role in presenting the required contents, teaching materials and demonstrating expensive Biology lab practicals as well as field lessons. In connection to this, MOE (2010) claimed that considerable investment has been made by the Ethiopian Government in ICT infrastructure, especially at secondary school level. In addition, MOE disclosed that currently 71.6% of secondary schools are equipped with PTV and 26.1% of them have access to internet services. According to it, some 3,409 PTV programs have been produced and broadcasted through 12 satellite channels to secondary schools (Appendix V).

Justifying the reasons for the integration of PTV in Ethiopian secondary schools, FDRE (2004) argued that PTV: presents abstract concepts in a simplified manner, transmits uniform education to many students found in different places at the same time, enables students to have access to model and competent teachers, and demonstrates laboratory equipments found in one place (classroom) to other learning classrooms in the country.

Additionally, in one of its educational pamphlets, MOE (2004) claimed that the technology-aided education helps the government to offer quality and equitable education for all children in the schools. The
following is the English version of the Amharic (official language) pamphlet’s excerpt as translated and cited by Hussein (2006) that states the six benefits of PTV in Ethiopian secondary schools. According to the pamphlet:

i. By merging movement with images, PTV enables teachers to teach students effectively and to offer them a clear presentation of otherwise complex and obscure concepts: A picture is far better than thousand words!

ii. PTV is the easiest and most effective way to give students and their teachers the fastest access to the most up-to-date information;

iii. PTV enables (teachers) to deliver educational concepts in a simple and precise way;

iv. PTV ensures the delivery of similar educational programs simultaneously to thousands of students in different corners of the country;

v. PTV offers (students and teachers) the opportunity to see and listen to model and effective teachers at the same time and when it is spread throughout the country, PTV becomes a cost-effective strategy.

In line with the above arguments, a study report by Gottschalk (1995) emphasized on the importance of videos, and recommends taking advantage of video's ability to show movement to: (i). Demonstrate the operation of tools and equipment, (ii). Conduct experiments in which the processes must be observed, (iii). Demonstrate skills that learners are expected to emulate, (iv). Analyze change over time using animation, slow motion, or time lapse photography, (v). Reveal the spatial, three-dimensional qualities of an object or structure, (vi). Transport learners to places or situations not otherwise in their experience, and (vii). Present primary source materials for analysis, such as films of historical events or naturally occurring situations.

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Since PTV involves multimedia (combination of various digital media types such as texts, images, audio and video), relay of information to the audiences [the students] will also engages multi-sensory system. According to some theories of learning (such as constructivists, Jonassen, 1991; Nkom, 2008) the more the sensory organs involved, the more learning will be. In connection to this, studies by scholars such as Gillani (2005) indicated that learning through hearing alone proves to be the least effective means of learning. She also pointed out that one learns only 11% by hearing as against 83% by seeing. As far as retention of the contents learnt through hearing is concerned, learning through hearing again stands at the lowest ebb because after three days, we recall only 10% of what we learnt through hearing as against 50% of what we learnt through both hearing and seeing; and 90% of what we acquired by applying three of our senses i.e. seeing, hearing and doing. In addition to that, Nkom (2008) stressed that the more the number of senses involved in the learning process, the more enduring the learning results.

Analytically, corroborating the above views, Kindler (1993, cited in NOUN, 2008) inferred that people generally remember: 10% of what they read, 20% of what they hear, 30% of what they see, 50% of what they hear and see, 70% of what they say, 90% of what they say as they do.

Thus, it is a time-tested truism that learning would be most effective when all the senses are involved – hearing, sight, smell, taste and touch. The whole is greater than sum of its parts.

Lastly, several experimental studies have proven that using TV in the teaching of general and specific Biology contents (such as catabolic and anabolic reactions – photosynthesis and respiration; Ecological concepts - species composition, diversity and interaction, etc) greatly help students learning and retention of the subject matter learned. Among myriads of studies, the following can be cited as evidences. Use of animations and simulations in teaching Cell Biology (Stith, 2004); Secondary school Biology (Environmental Biology; Man and Biology;
Gene, Inheritance and Evolution) (Gillani, 2005); Human Biology (Circulatory and Auditory system and their three-dimensional (3D) mock ups on TV; and Lower animals (Syrocki and Smagorinsky, 1960); Child development and family life, food and nutrition (Medved, 1966).

2.5.4. Technical Advantages and Disadvantages of PTV

Any instructional technology can have its own advantages (strengths) and disadvantages (limitations). PTV among them has its own advantages and limitations compared to other ITs including other types of TVs (such as regular or Cathode-Ray Tube TVs, LCD TVs, etc). In relation to this, comparative merits and demerits of PTVs, LCD TVs and Cathode-Ray Tube TVs are studied by Weber (2005), cited in CPS (2005), and TOPCC (nd). It is generally believed that the more up-to-date the technology, the more facilities it posses and display multimedia in a better way and cater for educational purposes. The detail discussion on the merits and demerits of the various types of TVs may not serve the purposive of the study. However, it suggested that having clear know-how on the strengths and limitations of each TV set in relation to the effective classroom instruction may be helpful for institutions that might be interested in integrating these technologies in their education system.

2.5.5. Challenges in Integrating PTV in Teaching Secondary School Biology

There are numerous challenges that emerge and influence integration of ICT in education in general, and PTV in particular in teaching secondary school Biology in Ethiopian context, in this study. As literatures indicate, integration of ICT is a complex process of educational change, and the extent of ICT applications in schools is still extremely varied and, in many instances, very limited (Kirschner and Selinger, 2003; Loveless and Dore, 2002; Scrimshaw, 2004), cited in Tondeur (2007). In connection to
this, WordNet (1997), cited in Schoepp (2005), claimed that the act of integrating ICT into teaching and learning is a complex process and one may encounter a number of difficulties; and these difficulties were termed as "barriers". A barrier is defined as "any condition that makes it difficult to make progress or to achieve an objective" (Ibid). In this study, the term ‘Challenge’ is synonymously used with barrier (factor).

A number of studies identify several groups of factors or barriers to technology integration into classroom teaching-learning processes. For instance, cited in Abdo and Semela (2010), Teo (2008), Neo (2007), and Rakes et al., (2006) revealed arrays of factors (barriers) associated with technology integration in school as discussed below.

Several studies have divided the barriers into two categories: extrinsic and intrinsic barriers. However, what they meant by extrinsic and intrinsic differed. For instance, Ertmer (1999) referred to extrinsic barriers as first-order (such as access, time, support, resources and training) and intrinsic barriers as second-order (such as attitudes, beliefs, practices and resistance), whereas Bingimlas (2009) saw extrinsic barriers as pertaining to organizational rather than individuals and intrinsic barriers as pertaining to teachers, administrators, and individuals.

Still another classification found in the literature (such as Bingimlas, 2009) is teacher-level barriers vs. school-level barriers. BECTA (2004) grouped the barriers according to whether they relate to the individual (teacher-level barriers), such as lack of time, lack of confidence, and resistance to change, or to the institution (school-level barriers), such as lack of effective training in solving technical problems and lack of access to resources. Similarly, Balanskat et al., (2006), cited in Bingimlas (2009), divided barriers into micro-level barriers, including those related to teachers’ attitudes and approach to ICT, and meso-level barriers, including those related to the institutional context. The latter added a third category called macro-level (system-level barriers),
including those related to the wider educational framework.

Another perspective presents the obstacles as pertaining to two kinds of conditions: material and non-material (Pelgrum, 2001). The material conditions may be the insufficient number of hardware or software. The non-material obstacles include teachers’ insufficient ICT knowledge and skills, the difficulty of integrating ICT in instruction, and insufficient teacher time (Bingimlas, 2009).

Furthermore, studies (such as Schon, 1987b, as cited by Lee, 2007) identified that barriers to the use of ICT in classrooms are often very subtle and that they don’t present themselves to practitioners as well-formed structures, but as messy and indeterminate situations. Hadley and Sheingold (1993), Schofield (1995), Becker (2000), and Dawes (2001), cited in Hennessy, et al (nd), on top of interpersonal and pedagogical factors, identified other contextual factors which can act as barriers to using ICT. These factors included: lack of confidence, experience, motivation, and training; access to resources and timetabled use of dedicated ICT suites; unreliability of equipment; classroom practices which clash with the culture of student exploration, collaboration, debate and interactivity within which much technology-based activity is said to be situated.

Still, many studies (such as Al-Alwani, 2005; Gomes, 2005; Osborne and Hennessy, 2003; Özden, 2007), as cited by Bingimlas (2009), have been conducted to investigate barriers to the integration of technology in education and in particular in science education, Biology among them. In connection to this, Al-Alwani (2005), cited in Bingimlas (2009), argued that identifying the fundamental barriers may assist teachers and educators to overcome these barriers and become successful technology adopters. Identification of barriers which exist within specific subject areas was also emphasized by BECTA (2004).

In line with this, in his study *Effective technology integration*, Cuban (2000), cited in Dunlap (2002), strongly reminded teachers,
administrators, parents, and techno-reformers to step back and evaluate why and how instructional technologies are being used to see if they can be used more effectively, efficiently, and cost-effectively. Furthermore, his study showed that many teachers were not willing to use the technology they have. He also clearly pointed out the implication that if the technologies at hand are not being used, they can’t be used effectively and hence will not help to achieve the educational goal.

Though there are several factors that positively or negatively affect the successful integration of ICT in general and PTV in particular, for the sake of the present study, only selected factors that have facilitatory or hindering roles in PTV integration in Ethiopian secondary schools are looked at. Accordingly, the following sections are mainly devoted to reviewing of the existing literatures in reference to attitudes of teachers and students towards PTV integration; clarity of language and pace of PTV broadcast; the tradition of time sharing among students, classroom and PTV teachers; active-learning vs. PTV lesson broadcast; condition of teachers’ professional improvement/development plans (trainings and awareness creating plans) and their [teachers’] competency in PTV integration; and reviewing of ‘global’ experiences with regard to TV integration into the classroom teaching-learning practices.

2.5.5.1. Attitude

Attitude is one of the crucial factors that determine the successful integration of ICT into the classroom teaching-learning activities, i.e., the type of attitude (favorable or unfavorable) school stakeholders (such as teachers, students, parents, etc) hold immensely affects the effective integration and utilization of ICT in the classroom.

In their study, Campbell (2001), and Stratford (2000), cited in Lee (2007) contended that teachers’ attitudes towards the use of ICT in teaching seem to be a crucial factor for meaningful and effective ICT integration. There have been attempts by researchers to describe the
processes involved in the role of attitudes, intention, beliefs, and ultimately behavior (Fishbein and Ajzen, 1975), cited in Roussell (1996). Roussell (1996) augmented that the effectiveness of an instructional technology centers around the premise that attitudes are linked to behavior and can have an influence on activity.

In another study, Borko and Putnam (1995), and Fullan (2001), cited in Tondeur (2007), described that teacher experiences, beliefs, emotions, knowledge, skills, motivations, etc interact within any learning context. Teachers’ perceptions about and actions towards changing and developing their teaching methods are influenced by what they believe, as well as their knowledge.

Furthermore, technological competencies of teachers have an attitudinal dimension also. As Cabanatan (2003), cited in UNESCO (2003) reported, among the ICT competencies required of teachers are a positive attitude towards ICT, along with a clear understanding of the educational potential of ICT.

Success of students’ learning by using ICT depends largely on teachers’ attitudes towards ICT (Teo, 2006). If teachers show positive attitudes towards ICT, then they can easily provide useful insights about acceptance and usage of ICT in teaching for students. Many researchers emphasized on the dimensions of attitudes towards ICT. Some examples are perceived usefulness of ICT and confidence about using ICT; training; gender; anxiety and liking/disliking (Tsitouridou and Vryzas, 2003).

Integration of ICT into science and technology curricula and classroom practices can be achieved by science teachers showing positive attitudes toward ICT. Robbins (2000), cited in Tondeur (2007), concluded that teachers’ attitudes and beliefs play an important role and seen as the main factors in implementing change (i.e. ICT integration).

Equally important is the attitudes, beliefs and perceptions students hold towards the integration of ICT. A number of studies (for example, Sipilä, 2009; Edmunds, Mary, Conole, 2012; Kubiatko and
Haláková, 2009; Simsek, 2008; Kubiatko, 2010; Cooper, 2006; Rumpagaporn, 2007; Khunyakari, Mehrotra, Natarajan, and Sugra Chunawala (nd) have been conducted in an attempt to investigate factors that render students to be technophiles and technophobic; and the relationships such as between students attitudes and successful ICT integration; student attitudes and their achievement in view of ICT-supported classroom teaching; attitude-gender-achievement differences and attitude-residence-achievement differences in ICT-based classroom teaching and so on.

Especially, Kubiatko (2010), in his study, Students’ Attitudes towards ICT Used in Science Education in Czech, found that attitudes towards ICT using in science subject among high school students were shown positive, and students considered ICT supported science subject classes interesting. Similarly, Kubiatko and Halakova (2009), cited in Kubiatko (2010), asserted that secondary grammar school students had positive attitudes towards ICT for teaching and learning Biology. In another study, the Impact of ICT on Learning and Teaching, Baker, Gearhart and Herman (1994), and Kulik (1994), cited in Newhouse (2002), found that students demonstrated a more positive attitudes towards their classes and learning when ICT use is included. Similar findings were also reported by, such as, Sipilä (2009).

2.5.5.2. Pace of Educational Broadcast

Pace is another important factor that determines the successful integration of ICT into classroom teaching-learning processes. In this study, pace refers to the speed by which educational broadcast [through PTV] is transmitted according to the schedule set by the MOE.

We don’t expect uniform student population in a given classroom. Students in a given classroom can differ in many aspects such as with respect to their backgrounds - rural/urban; pace of learning - fast, medium or slow learners; achievement- high, medium or low achievers;
and etc. Thus, the educational broadcast by PTV should consider the diversity of students. The uniform broadcast (fast or slow) may not meet the special needs of varied groups of students. For instance, fast broadcast may be ideal and satisfy the needs of some groups of students (such as fast learners), while the same broadcast may not fulfill the needs and interests of other groups of students (such as slow learners) and can adversely frustrate them.

In connection to this, a number of researches have been conducted including Lemma (2006); Bitew (2008, 2010); Hussein (2006); and Tessema (2006). In particular, Bitew (2008) in his study investigated that, in addition to the language problem, the speed of PTV was another major problem mentioned by most of his respondents (81%). Furthermore, Gebremedhin (2008) in his study observed that students didn’t get the chance to predict answers for the questions displayed on PTV screen as the time given elapses before students attempt them. He added that inadequate time, compounded with too long and rapid speech of the PTV teachers frustrated students. Thus, he inferred that, as pre-college students, they were unable to perform well to the extent required of them. This assertion go in line with what Lemma (2006) investigated before. In connection to this, one of the interviewed respondent teachers in Bitew’s (2008) study commented: “PTV transmission is very fast, we can’t control it and the instructional time ends without the students understand the content”. This comment implies the speedy and non-repeatable nature of PTV transmission.

Besides, Bitew (2008) remarked that unless the transmissions are copied for later use, students face difficulty in learning through direct or live transmission. He also revealed his concern that copying and distributing CD copies of the PTV lessons to schools also seems practically impossible in the cases of government schools because they have no equipments (such as printers, and other stationary materials) to do so. He observed that neither the teacher nor the students have control
over the transmissions. It is pre-programmed so that it didn’t satisfy the needs of the students. This kind of education system requires the students to adjust themselves to the technology which replaces the teacher. In line with this, Tessema (2006) and Hussein (2006) commented on the newly introduced transmission when they say: “one-size-fits-all” approach to education and thus doesn’t cater for the diversity of the students. These findings are congruent with what Bitew (2010) found and in which he concluded, “...PTV was also too fast to understand, pre-programmed, non-rewindable, and non-repeatable in character.”

2.5.5.3. Time

Time is the other important factor in ICT integration. The effective integration of ICT into the classroom teaching-learning process highly depends on the amount of time given to teachers and students. Educational activities are essentially time bound. In this study, time refers to the duration in which educational broadcast through PTV is transmitted and implemented according to the time table set by the MOE (Appendix V). Furthermore, it refers to duration (amount of time) given to teachers and students to carry out their various academic activities in the classroom before, during or after PTV lesson broadcast.

In Ethiopian secondary schools, the time set for teaching a given subject (for e.g. Biology) is split in to two categories: (i) time when PTV is used (plasma period-PP) and (ii) time when PTV is not used (Non-plasma period-NP). Further, the time allowed for one period (which is equal to 40 minutes) in the PP is divided into two as the first 20 minutes for PTV teacher and the remaining 20 or less minutes for the classroom teacher, whereas in the absence of PTV lesson broadcast, i.e. NP, the whole 40 minutes are used by the classroom teacher (Appendix V).

Since time is a scarce resource we have and which coerces us to schedule or plan our activities to get done right, the efficient and effective
utilization of it [time] determines our achievements of the objectives, goals or plans. On one hand, the amount of time given determines the amount of activity to be accomplished. On other hand, lack of expertise in effective and efficient utilization of time unfavorably affects our goals and hence achievements. For instance, in the teaching-learning contexts, the amounts of time teachers and students have will determine their interaction and activities to be accomplished. These interactions and activities are crucial in education for better learning to occur.

Several researches have investigated the impacts of amount of time given for a given subject, in particular for specific activities in the teaching-learning processes, especially in ICT enhanced classroom learning (for instance, in PTV-based classrooms). Among them, Bingimlas (2009); Sadik (2008); Bitew (2008, 2010); Mize and Gibbons (2000); Robelen (1999, cited in Dunlap, 2002); Al-Alwani (2005) and Gomes (2005) reflected in Bingimlas (2009) are some of the reviewed literatures.

Teachers need time to reflect. Time is the biggest barrier to technology integration (Robelen, 1999). In connection to this, Bingimlas (2009) considered lack of sufficient time as one of the major barriers in technology integration in schools. Furthermore, Al-Alwani (2005), cited in Bingimlas (2009), indicates that lack of time is an important factor affecting the application of new technologies in science education. In one study, Mize and Gibbons (2000) found that the most common comment made by surveyed teachers who didn’t have a clear vision of IT integration was that they didn’t have enough time to integrate IT on top of everything else that they were to teach daily. In another study, Chowdhury (2009) investigated that ICT integration takes time away from actual classroom instruction and this assertion was indicated by majority (87.6%) of his respondent teachers. This observation supported the finding of the study conducted by Dillon, Osborne, Fairbrother and Kurina (2000), cited by Osborne (2003), in which they revealed that lack of time was the most significant constraint on ICT use as quoted by most
of the respondents (86-88%) of primary and secondary science teachers surveyed.

Thus, Osborne (2003) remarked that using ICT in limited and constrained ways can curtail the potential offered by ICT for learning science and developing the skills required by contemporary curricula. The implication is that teachers and students should have sufficient time to celebrate the tradition of interaction in dealing with various academic issues in the school.

**2.5.5.4. Language of Instruction**

Language is the other critical factor that highly influences the effective integration of ICT into the classroom. Effective communication between students and teachers (PTV teachers) is greatly affected by the type, understandability and sophistication of the language used in the ICT-based classroom teaching.

In Ethiopian curriculum, English language is given as a subject for elementary and secondary schools (grade one through twelve), whereas all the rest subjects are offered in mother tongues for elementary schools (grades 1-8). However, in secondary schools (9-12) all the subjects (except few local languages) are instructed in English medium. Currently, in all secondary schools where PTVs are installed, school subjects are instructed through English language medium.

One of the purposes of the televised lessons in Ethiopian secondary schools was to address the poor standard of English language of many of the teachers in the country. The PTV lessons were designed to provide models in order to enhance the language of teachers and pupils. The assumption was that, since all televised lessons are transmitted in English language, teachers and students will have opportunity to listen to fluent PTV speakers on a daily basis in all the subjects, and thus believed to help them improve their fluency in English language skills.
However, as different literatures indicate, the performance of secondary schools’ students in Ethiopia in English language skills (speaking, writing, listening and reading), not to mention elementary schools students’ performance, is generally poor (Gebremedhin, 2008; Ridley (nd); Bitew, 2008; Lemma, 2006; Gebreyohannes, 1988). In his study, Bitew (2008) investigated that English language was one of the major problems reported repeatedly by all of the participant students in the Government schools where school subjects are taught by PTV. Similar observations were made by Lemma (2006). Bitew (2008) suggested that English language skills of students should be improved before the language becomes a medium of instruction. Furthermore, he reported his classroom observation when he says:

Students were passive and dissatisfied with the PTV mode of instruction. The major factors associated with the students’ dissatisfaction were the high level of English language skills assumed by the “plasma” teacher; the speed of the presentations created difficulties for conceptual understanding. There was a lack of class time for the students to discuss with their teachers and fellow students.


As evidenced from researches conducted in Ethiopia on causes of dropout rates in higher education, poor language skills were one of the root causes of students’ failure (Ridley (nd)). Ridley (nd) pointed out that pupil with a good command of language benefited from the PTV programmes in terms of language acquisition and subject knowledge.

In another study, Curzon (1993) argued that, in televised lessons, TV teacher suffers from the disadvantage of not knowing the reactions of his audiences (the students), since the TV teacher can’t generally assess the effectiveness of his efforts to communicate, and without
communication teaching is impossible. Furthermore, he contended that where there is no informative feedback, there can be no effective control over learning. In connection to this, Sharma (2003), cited in Gebremedhin (2008), concluded that satellite TV is less effective when the feedback response is important, and when discussion and give-and-take between the student and the teacher are needed.

2.5.5.5. Active Learning (AL) vis-a-vis PTV Educational Broadcast

This section presents reviews of the related literatures with respect to the extent of implementability of active learning (AL) in light of PTV lesson broadcast. In another words (interrogatively), is the current teaching-learning practices through PTV in Ethiopian secondary schools in harmony or on contrary to the implementation of active leaning (or else called student-centered learning) methods? It is a time-tested fact that effective implementation of active learning methods result in a better learning and achievement.

In line with this, myriads of literature reviews (such as Demelash, 2000; Ayalew, 2003; Newhouse, 2002) generally reveal that active learning is superior to traditional teacher-dominated method of teaching.

In essence, AL is a more hands-on, thus mind-on approach to learning, which involves experiential and practical learning. Thus, it is a student-centered learning. It involves active engagement of students in the learning process and is contrasted with passive learning, whereby students take in information passively.

AL is based on the constructivist learning theory, which holds that students are actively engaged in learning, process information by reconstructing it in a new and personally relevant manner. New cognitive structures are created in the brain to connect his or her “old” information to the “new” information. The application of the “new” information leads
to deeper understanding and significantly improved retention (Ayalew, 2003).

There are pre-conditions (determinant factors) for the effective implementation of AL. For example, it requires input of appropriate and sufficient resources – human, material and other resources such as sufficient time and skill. Also required are manageable class size (number of students per class or teacher-student ratio), comfortable learning rooms, commitment and willingness, especially from teachers, etc. A number of literature reviews (such as Ayalew; Demelash, 2000; Ridley (nd); Newhouse, 2002) also consolidate the foregoing idea that successful implementation of AL methods require prior fulfillment of the necessary conditions.

Failure to meet the minimum of these pre-conditions (determinants) most likely leads to the failure of implementation of the AL methods in the classroom. With reference to this, Demelash (2000) identified important factors (in Ethiopian context) contributing to the failure of implementing learner-centered methodology as: teachers' lack of necessary skills and knowledge, cynicism and sabotage of some staff members and inadequacy of time were some of the perceived problems that hindered the full adoption and effective implementation of learner-centered instruction.

Biology is among the disciplines that should be learned actively. Students can be fully engaged in various Biology contents in classrooms, labs and field works. Effective implementation of various active learning methods obviously results in a better understanding of the Biological concepts and improve their performance of the same.

Although FDRE (1994, 2004), in its policy documents *Education and training policy/Teacher Education system Overhaul (TESO)* highlighted the significance of AL and its implementation strategies in the entire grade levels (elementary through University) throughout the country, the practicality of this policy has been challenged by the various
factors. Among the factors (as mentioned above) exist is the implementation of PTV-based instruction at all the secondary schools. PTV-based instruction uses almost half of the class time. On the other hand, AL is a time requiring learning method. The government wants the two methods (Plasma education and AL) to be integrated simultaneously and amicably into the classroom teaching-learning processes. However, harmonizing the two methods of teaching has been reported to be a challenge. Time is the major constraint. PTV implementation requires sufficient time, so is AL. Attempting to implement one of the methods is depriving of the time of the other method i.e. teachers use one method in the expense of the other instructional method. As a result of that some teachers opt to use AL, while others PTV-based instruction. There appears to be confusion and lack of uniformity. Thus, as one of its objectives, this study assesses the views of respondents on the extent of harmonization of PTV-based instruction and AL in the teaching-learning practices of Biology.

2.5.5.6. Training

Like attitude, time, pace, and instructional language; the availability, type and duration of trainings to teachers also affect the successful integration of ICT by affecting teachers’ awareness, competence, confidence, pedagogy and skill. Since these factors (confidence, competence, etc) are determinants that have great bearings on building teachers’ capacity for effective ICT integration, they are deemed to be tackled through providing relevant and continuous trainings to in-service teachers. Also induction programmes are needed to novice teachers.

Thus, in this section, related literatures were reviewed on the availability, type, significance and impacts of trainings on empowering teachers to effectively integrate ICT into their classroom teaching/learning activities.

FDRE in its various policy documents (such as FDRE, 1994; 2004;
MOE, 2010), emphasized on the importance of training and empowering of teachers through Continuous Professional Development (CPD) with the aim of enabling them to be creative, competent, ethical, and effective; and to produce teachers who are committed, willing and possessed expertise and know-how in integrating ICT in education to improve the quality of education.

In relation to this, research clearly shows that in order to generate major changes in teaching practice, PD must be ongoing and long-term (Orrill, 2001), cited by UNESCO (2003). It is also stressed that if educators are to acquire the necessary skills, to have opportunities to reflect on the changes needed in their classrooms, and move toward a more learning-centered classroom; educational agencies (such as schools) must have CPD plans that provide appropriate training and support on a continuous basis; and building capacity is critical for schools to provide optimum learning environments for students in the 21st Century (UNESCO, 2003).

Furthermore, Lee (2007) remarked that as teachers are regarded as absolute cornerstone of education, CPD of teachers is inevitably a key component of successful ICT integration. The above argument corroborates research findings reported by a number of literatures such as Pea (1998); Chaptal (1997) and McKenzie (1993), cited in Lee (2007). It is argued that infrastructures and technical equipments are not the only prerequisites for a successful ICT integration; rather, the successful integration of ICT depends on the involvement of teachers because it is not technology that makes teaching successful but the efforts of teachers.

However, It is widely criticized that the trainings offered to teachers are mostly broad (non-targeted) and short-term that also lack follow-up. In line with this, literatures such as Sandoltz et al (1997), as cited in UNESCO (2003), stated that providing adequate and appropriate PD is the most widely discussed aspect of effective practice advocated in
educational literature, and yet it is too seldom implemented. Far too much PD is short-term in nature and not followed up. Vannatta and Fordham (2004) and Ferneding (2003) added, “Although technically oriented training for teachers is a common channel to provide support to teachers for ICT integration in many countries and regions, such as Hong Kong, these training programmes are criticized for not being able to promote in-depth integration of ICT into teaching and learning”.

MOEST (2005) in its study (Kenya) stated that the most logical assumption, to enhance the quality of learning through the use of ICTs, is to improve capacity of teachers and use ICTs to support and facilitate instruction and classroom management. It also noted that providing access to ICTs is not sufficient in itself to improve the quality of students’ learning, and technology can’t replace teachers.

Finally, Fullan and Mascall (2000) concluded that PD is a key to the success of any reform initiative. And therefore, to promote excellence in ICT in education, PD is deemed necessary to ensure that teachers would be prepared to realize the potential of these technologies.

2.5.5.7. Technical qualities of and Power supply to PTV

Reliable technical quality of and unfailing source(s) of electric power supply to PTV have great contributions in assuring uninterrupted PTV lesson broadcast. In this study, technical quality of PTV refers to its (PTV’s): physical strength, ability to display/present quality multimedia (text, image, video, audio, diagrams, charts, etc), conditions of operation (proper/malfunctioning) and its suitability for classroom lesson presentations. Likewise, power supply refers to the conditions and source of electricity required to run PTV lesson broadcast in Ethiopian context.

Nowadays, more than 550 Ethiopian secondary schools are already equipped with PTVs and six major subjects (Table 1) are broadcasted. PTVs, like any other electronic broadcasting media, are prone to malfunctioning due to various reasons (such as damage/breakage).
However, the effects of malfunctioning seriously affect the teaching/learning processes if the teaching-learning process is entirely ICT-dependent (learning by ICT) such as PTV-based instruction in Ethiopian case. Since most of the theoretical and practical lessons are presented by PTV, the failure of PTV gravely affects students’ learning. This is because once they [students] miss the lessons; they miss them for good, i.e. students will not have other means of obtaining or compensating them as PTV lessons are non-rewindable, non-repeatable or not recorded. This creates anxiety, frustration, pressure and lack of confidence on students as well as on teachers. These conditions ultimately affect students’ learning and their academic achievements negatively.

Myriads of reviewed literatures (such as Osborne, 2003; Newhouse, 2002; Bingimals, 2009; BECTA, 2004; Sicilia, 2005; Meless, and Teshome, 2006; Belay, 2008; Gebremedhin, 2008; Hussein, 2006; Bitew, 2008; Fufa (nd), Lemma, 2006) also reveal the harmful effects of the failure of ICT tools while integrating them in the classroom teaching-learning processes. Especially, Sicilia (2005) argued that whatever kind of technical support and access teaching staff have and whether they have twenty years of experience or are novices to the profession, technical problems of ICT tools generate barriers to the smooth delivery of science lessons by teachers. This conception was augmented by Bingimal (2009). Similar findings were also reported by Osborne (2003).

In another study, Dawes (2001) and Schofield (1995), cited in Osborne (2003), identified a number of contextual factors that greatly affect ICT integration into classroom teaching-learning activities. Among other factors (such as teachers’ lack of confidence, experience and training; lack of a supportive organizational culture within the school; limited access to resources and timetable use of dedicated ICT suites), unreliability of ICT equipments and lack of adequate technical supports have been emphasized.
In their study, Belay (2008); Gebremedhin (2008); Meless and Teshome (2006); and Takeuchi (2008) pointed out that frequent PTV’s technical failures and interruptions of the transmissions were common events in their study areas in Ethiopia. Furthermore, Takeuchi (2008) reported that the PTV technicians assigned to schools to handle problems related to PTV were not only insignificant in number, but also not well-trained. Compounded with these problems were shortage and lack of spare parts to PTV. Most of the spare parts have been imported from the abroad via only limited companies only when need arises. In line with this, in one of its reports, MOE (2010) revealed that shortages of spare parts were not the only challenges, but also insufficiency of PTV screens in the emerging regions presented another challenge to ensure educational equity and quality in Ethiopia.

The other important issue related to the technical aspect of the PTV was the conditions of power supply to it [PTV]. As clearly indicated in the introductory part of this thesis (section 1.1), Ethiopia is one of the poorest countries in the globe. Not to mention other problems, provision of adequate power supply to its citizens has been a challenge and bottleneck to the county’s economic development. Ethiopia is mainly dependent on hydroelectric power as a source of energy for all its energy demanding sectors. Although Ethiopia is engaged in the construction of further inspiring intensification and massification hydroelectric power projects, they are not yet completed and functional till to date to alleviate the power problem.

Schools installed with PTVs are one of the sectors in the country requiring high amount of power supply to run the educational broadcast. However, as different local studies (such as Lemma, 2006; Bitew, 2008; Hussein, 2006; Fufa (nd); Gebremedhin, 2008; Belay, 2008; Meless and Teshome, 2006) reveal, PTV transmission interruptions were very common during the broadcast because of sudden power failure and power cut (shift-based power supply). During the researcher’s tripe to
sampled schools for data collection, “no power” was a buzzword in most of the schools visited, and it was noted that a number of Biology episodes (both practical and theoretical) were missed due to the power interruptions.

2.6. ‘Global’ Experiences: What can be Learned for the Effective Integration of PTV in Ethiopian Secondary Schools?

This chapter presents an overview of the experiences of some selected developing and developed countries in respect to the tradition of instructional TV integration (ITV) in education (Table 2 below). These countries belong to Commonwealth countries and deliberately chosen for the purpose of reviewing of the experiences in ITV integration. This is because: (a). Some of these countries belong to ‘developed countries’ (such as Canada, Australia, India) and others belong to ‘developing countries’ (such Botswana, Cyprus, Mauritius, etc) (b). Ethiopia, as a developing country, has many characters in common to share with/from both groups of countries (c). As a visionary country, Ethiopia has a lot to learn from developed countries. (d). The required data in this regard were already available in an organized form such as from CEMCA (2003).

The information presented in this section is by no means exhaustive. Only few points under selected areas are reviewed. Thus, the areas of focus of lessons (experiences) to be learnt include: (i). Time allotment (ii). Languages of broadcast (iii). Manner of integration (supplementary or compulsory) (iv). Ownership of the broadcasting centers (Government, private or both) and (v). Availability of alternative instructional channels. In addition, the experiences of Mexico and Brazil were adopted (not members of the commonwealth). Accordingly, the major lessons learned from the targeted countries’ experiences of integration of ITV into the classroom teaching-learning practices are summarized as follows.
i. Manner of integration. All the depicted countries integrated ITV education as a supplementary/enrichment material. In this regard, Ethiopia is the sole country to integrate PTV education as compulsory learning material. Compulsory is to mean that learning will not be possible or at least difficult without PTV.

ii. Tradition of broadcasting time. The length of broadcasting time varies from country to country (such as India about 22 minutes per day for different age groups; Australia 4 hours per week, Brazil 1 hour and 45 minutes per class, Mexico 30 hours per week and so forth). In this regard, however, the length of broadcasting time by PTV in Ethiopia ranks first. Mostly, there are two shifting systems in Ethiopian secondary schools – morning and afternoon shifts. Each shift receives 2 hours broadcast (20 minutes per subject). Accordingly, the PTV lessons are aired for a total of 4 hours per day. Time specifications were not indicated for some countries.

iii. Contents of broadcast. The focus of broadcast varies too. In most cases, the contents are multidisciplinary and multipurposed. In this respect, educational broadcast by PTV in Ethiopian context is entirely academic/curriculum oriented.

iv. Interactivity of the broadcast. As to the interactivity, mixed practices were observed. Some countries have both interactive and non-interactive educational broadcasts (e.g. Australia, Botswana), others (most of them) have non-interactive (e.g. Namibia, Cyprus, Fuji, etc) mode of broadcast. In this regard, Ethiopia comes under the later groups of countries.

v. Language of broadcast. The languages used for the educational broadcast through TV vary greatly among the countries. For instance, India’s educational broadcasting TV uses five languages - Oriya, Telugu, Marathi, Gujarati and Hindi for different levels; Botswana uses Setswana and English; and Fiji uses seven different languages, and so forth. In this regard, Ethiopian educational
broadcast by PTV uses only one language – English language though it is a tough medium of learning for the students. English is not a home language to Ethiopians.

vi. Alternative educational channels. Most of the countries such as India, Canada, Australia, Samoa, South Africa, etc have alternative educational TV broadcasts. However, Ethiopia has only one formal satellite educational broadcast through PTV.

vii. Ownership of the educational broadcasting centers. In this regard, mixed practices (private and government) were observed even though most of them are owned by government. In this regard some countries such as Canada practices both private (decentralized) and Government (centralized) ownership and encourages private sectors to participate/invest in educational broadcasting services. In this respect, Ethiopia has only one government owned formal educational broadcasting service to schools.
table 2. ‘global’ instructional/educational tv integration experiences.

<table>
<thead>
<tr>
<th>name of country</th>
<th>broadcasting agency (corporation)</th>
<th>owner (gov’t/public/private)</th>
<th>broadcasting time</th>
<th>condition of integration</th>
<th>focus or contents of broadcast</th>
<th>remarks (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>India</td>
<td>doordarshan</td>
<td>government</td>
<td>45 minutes daily (22½ minutes for each upper &amp; lower levels)</td>
<td>supplementary (enrichment)</td>
<td>multi-disciplinary &amp; multipurposed</td>
<td>india has a number of other educational channels; broadcast is for different age &amp; grade levels</td>
</tr>
<tr>
<td>australia</td>
<td>australian broadcasting commission</td>
<td>government</td>
<td>4 hours per week</td>
<td>supplementary (enrichment)</td>
<td>multi-disciplinary &amp; multipurposed</td>
<td>interactive &amp; non-interactive; non-commercial; for grades 9-12 non-interactive non-commercial works in collaboration with brazil.</td>
</tr>
<tr>
<td>ethiopia*</td>
<td>eeictc</td>
<td>government</td>
<td>20 minutes per subject</td>
<td>compulsory</td>
<td>only six subjects are broadcasted (table 1)</td>
<td></td>
</tr>
<tr>
<td>botswana</td>
<td>botswana educational broadcasting tv</td>
<td>government</td>
<td>ns**</td>
<td>supplementary (enrichment)</td>
<td>multi-disciplinary &amp; multipurposed</td>
<td>government funded (next page...)</td>
</tr>
<tr>
<td>cyprus</td>
<td>cyprus broadcasting corporation</td>
<td>government</td>
<td>ns</td>
<td>supplementary (enrichment)</td>
<td>multi-disciplinary</td>
<td>(next page...)</td>
</tr>
</tbody>
</table>

* Placed for the sake of comparison.
** NS - broadcasting time not specified.

**Note:** Some counties prefer to call *Educational TV* while others *Instructional TV* to refer to TV lesson broadcast. Both are displayed.

* Television for Secondary Education: Experience of Mexico and Brazil (Mexico’s Telesecundaria & Brazil’s Telecurso 2000) were the other vital sources utilized. (Not members of Commonwealth countries, and hence, not included in Table 2 above). http://www.ictinedtoolkit.org/user/library/tech_for_ed_chapters/10.pdf

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<table>
<thead>
<tr>
<th>Country</th>
<th>Broadcaster</th>
<th>Ownership</th>
<th>NS</th>
<th>Type of Broadcasting</th>
<th>Programming Focus</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada</td>
<td>TV Ontario (TVO)</td>
<td>Government</td>
<td>NS</td>
<td>Supplementary (enrichment)</td>
<td>Multi-disciplinary &amp; multipurposed</td>
<td>Canada has other educational channels such as Careers TV, Academy TV, Knowledge Network etc</td>
</tr>
<tr>
<td></td>
<td>ACCESS Alberta</td>
<td>Private</td>
<td>NS</td>
<td>Supplementary (enrichment)</td>
<td>Multi-disciplinary &amp; multipurposed</td>
<td></td>
</tr>
<tr>
<td>Mauritius</td>
<td>Mauritius Broadcasting Corporation</td>
<td>Government</td>
<td>NS</td>
<td>Supplementary (enrichment)</td>
<td>Wide range of subjects</td>
<td>Programmes are mainly purchased.</td>
</tr>
<tr>
<td>S. Africa</td>
<td>South African Broadcasting Corporation (Public)</td>
<td>Government</td>
<td>vary</td>
<td>Supplementary (enrichment)</td>
<td>Multi-disciplinary &amp; multipurposed</td>
<td></td>
</tr>
<tr>
<td>Namibia</td>
<td>Namibia Broadcasting Corporation</td>
<td>Government</td>
<td>NS</td>
<td>Supplementary (enrichment)</td>
<td>Formal &amp; informal education</td>
<td>S. Africa has a no of TV series such as Yizo, Yizo, Soul Buddy, Gazlam</td>
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<tr>
<td>Samoa</td>
<td>American Samoa gov’t TV station</td>
<td>Government</td>
<td>NS</td>
<td>Supplementary (enrichment)</td>
<td>Multi-disciplinary &amp; multipurpose</td>
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<td>Fiji</td>
<td>Fiji TV</td>
<td>Government</td>
<td>NS</td>
<td>Supplementary (enrichment)</td>
<td>Multi-disciplinary &amp; multipurpose</td>
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<tr>
<td>Malta</td>
<td>Malta TV</td>
<td>Government</td>
<td>NS</td>
<td>Supplementary (enrichment)</td>
<td>Multiple programmes</td>
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