



ADDIS ABABA UNIVERSITY
SCHOOL OF GRADUATE STUDIES
COLLEGE OF NATURAL SCIENCES
DEPARTEMENT OF COMPUTER SCIENCE

**THE STATUS AND THE WAY FORWARD OF ICT CURRICULUM IN
ETHIOPIAN SECONDARY SCHOOLS**

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Acronyms and Abbreviations

ICT	Information and Communication Technology
IT	Information Technology
ICT4D	The National ICT for Development
EICTDA	Ethiopian ICT Development Agency
FGD	Focus Group Discussion
MOE	Ministry of Education
REBs	Regional Educational Bureaus
NGOs	Non- Governmental Organizations

Abstract

In today's modern world, acquisition of computer skills is becoming necessary for employment, educational development, and leisure. Tomorrow's world is an ICT one where information handling skills will be needed to improve the standard of learning and living. So, ICT education is very essential to improve our lives.

This thesis presents the research done to explore the status of ICT education curriculum in Ethiopian secondary schools and suggests the way forward to the future ICT contents by considering the experience of other countries in the world. Since the current ICT curriculum is in implementation, informally different educators commented as the contents are irrelevant to students at secondary school. Indeed, the contents were selected without need assessment study and without considering school readiness with resources and appropriate manpower.

The study revealed that schools have no sufficient resources like hardware, software and Internet infrastructure to teach ICT contents. This implies that students are unable to learn most contents due to lack of resources and training for teachers. This indicated that ICT curriculum is not implemented properly.

On one hand, the study concluded that, the teachers in most secondary schools of Ethiopia are not qualified for the level. Even there are schools which don't have enough ICT teachers. In addition ICT teachers don't obtain training with the current ICT curriculum and teach students only those simple contents and jump/leave others without covering with curriculum schedule.

On the other hand, the study revealed that in the current syllabi few ICT contents are not appropriate according to the knowledge and skills students developed at secondary school. Even though some contents of the curriculum are in standard with respect to other countries experience. Schools ICT laboratories situation is in question. The teaching/learning materials such as textbooks and teachers guides were not developed in suitable way. They are simply full of unnecessary details and leave some topics without clear guide to use software.

Therefore, the research recommends feasible ICT contents by analyzing educators' opinion and experience of other countries that ICT knowledge and skills students can again and develop at secondary school. Suggested ICT contents to secondary schools are computer systems, computer care and safety, computer and its application, computer and information ethics, basic computer troubleshooting (assembly and upgrading), Information system and social media tools, Networks and communication, Exploring the Internet, Basic application of ICT in real life, and Problem solving and basic programming concepts using web page design. Moreover, concerned bodies should give serious attention and supervision to fulfill schools ICT resources, to revise current ICT curriculum with relevant contents and provide in-service training for ICT teachers intensively.

Keywords:-ICT, ICT teaching in secondary school, ICT teaching resources, Ethiopian ICT Curriculum, Standard ICT contents, National ICT policy, ICT teachers knowledge & skills.

Chapter One: Introduction

1.1 Background

Information technology is a broad term used to refer to the ways and means by which information is processed and communicated using automatic systems, such as computers, telephones, and other telecommunication and office systems. Information and Communications Technology (ICT) becomes a vital part of the operation of most businesses and industries. The expanded use of computers in the society has increased the number of employment opportunity available to individuals with some computer-related experience or training. In addition, the increasing use of information technology in the contemporary society proves that ICT is absolutely necessary for development [1].

The United Nations Educational, Scientific and Cultural Organization (UNESCO) uses the term ICTs, or information and communication technologies, to describe: "...the tools and the processes to access, retrieve, store, organize, manipulate, produce, present and exchange information by electronic and other automated means. These include hardware, software and telecommunications in the forms of personal computers, scanners, digital cameras, phones, faxes, modems, CD and DVD players and recorders, digitized video, radio and TV programmes, database programmes and multimedia programmes" [2].

As we know, the world is dynamic and is changing fast. Some of these changes are social and political, others are ecological. Some are evolutionary, others revolutionary [3]. No matter where we plan to live or what we plan to do, we can expect that constant and rapid change will be normal part of life.

Technology, especially information and communication technology, is playing a large part in these changes. Advances in computer systems have facilitated advances in entertainment, in medicine, in military capacities, in the collection and dissemination of global news reports, and in the management of organizations. Continually evolving computer hardware and software have allowed organizations to significantly change their work process; new products and services have been developed, new industries have emerged, and old companies and industries have failed. Moreover, the technologies continue to expand in their capabilities and applications [1].

Increasingly in the modern world, acquisition of computer skills is becoming necessary for employment, educational development, and leisure. Computer studies intend to furnish students with a broad knowledge of the nature of information processing and how Information and Communications Technology (ICT) is used today [4]. Tomorrow's world is an ICT one where information handling skills will be needed to improve the standard of learning and living. The world is becoming connected electronically by the Internet, the world-wide network through which we can all share information.

According to Sanders [5], to be an educated citizen today, we must be acquainted not only with computers themselves but also with what computers do, how they are put to work, and how they affect individuals and organizations in a society.

In the report titled “The National ICT for Development (ICT4D) Five Years Action Plan for Ethiopia”, Dzidonu [6] mentioned that Ethiopia recognizing the developmental potentials and opportunities of the information and technological revolution has embarked on a process of economic transformation through the modernization of the key sectors of the economy including those of agriculture, services and industrial sectors through the deployment and the exploitation of ICTs. A key strategy is to pursue an agricultural sector development-led industrial strategy aimed at rural and agriculture centered development, guided by an ICT-driven competitive and market oriented development approach. Acknowledging the key role that development, deployment and exploitation of ICTs can play in Ethiopia’s economic and social development, the Government recognizes the need for the rapid development of the nation’s information and communications infrastructure as well as the development of the nation’s educational, human resources and other development-focused resources to bring about the necessary change and transformation required to achieve improvements in the determinants of the nation’s socio-economic performance.

Not only does the Government consider ICTs as an indispensable tool and means to alleviate poverty but it also considers ICTs as a major tool for facilitating the on-going state transformation which is aimed at effective and efficient service delivery. The Government therefore views ICTs within a wider context of its socio-economic development goals. The goal is to make Ethiopia an ICT-driven country able to function effectively in a networked global economy [6].

The project called SchoolNet arises from the need to integrate ICTs into Ethiopia’s educational system. It is designed to develop a wide-area network linking all schools in the country and making Internet and online education accessible to them. The initiative constitutes a key component of e-government programme and aims at the application of ICTs for the purposes of teaching and learning [6]. The broad objectives of this initiative are to:

- effectively deploy and utilize ICT to facilitate teaching and learning in Ethiopian schools;
- ensure that ICT and other educational delivery technologies are developed and effectively used to manage and administer the processes of teaching and learning;
- broaden access to learning and other educational delivery technologies to a wider section of pupils within the Ethiopian school system;
- support teaching and learning and improve the efficiency and effectiveness of administrative and service-delivery processes within the school system;
- promote and facilitate access to educational services and resources;

- ensure that school administrative, teaching and support staff all have access to ICT resources to enhance their effectiveness and efficiency;
- develop educational delivery infrastructure capable of delivering a wide range of educational application systems;
- provide access to educational services and resources for the benefit of learners, teachers and administrators.

In general, a full-fledged national SchoolNet program is expected to support the teaching and learning process, using the Internet as an educational development and delivery platform to support teaching and learning. Implementation of integrated SchoolNet system for Ethiopia will go beyond supporting basic teaching and learning. It also supports school administration and other non-teaching functions of the school system.

With the above national ICT strategy, the Ethiopian ICT syllabi is geared towards students who are in secondary school and is designed to equip them with knowledge of computer skills, the applied use in the world of work, and a background for further training. It includes theoretical and practical content in hardware, software, communication and data processing. Now the Ethiopian curriculum of ICT has been in implementation for about fourteen years but its status has not been yet explored. Therefore, from this crucial perspective that it is intended to conduct a study in Addis Ababa to compare the existing secondary school ICT curriculum in relation to other countries experience and to suggest the way forward for secondary school ICT/IT curriculum of Ethiopia.

1.2 Motivation

In Ethiopia, when the Ministry of Education approved the new education policy, new programs like ICT started to be implemented for preparatory program in secondary schools. At the beginning, the information technology discipline introduced application software only. After three years it was revised with some changes. Then, recently in 2008, ICT education is introduced with major changes for the whole secondary education from grades 9-12. Even if it is in implementation, some of the drawbacks that different computer science educators commented are as follows:

1. Naming of the discipline called ICT (Information and Communication Technology) is still controversial and needs some agreement among educators.
2. Some of the contents are not relevant and difficult to secondary school students. Moreover, when educational experts visited schools, resources are not available like kits for teaching computer maintenance and troubleshooting, and teachers' knowledge and skill is in question.
3. Contents at grades 11 and 12 have missing topics and insufficient sub topics to teach like revision about application software and others.

4. Some topics need software that are not easily available even for teachers to teach like Macromedia Flash, PhotoShop, Logo, Web Page Maker, etc.
5. Teachers and students commented as the textbook is very bulky, resources are not available. Teachers need training on most contents and have no confidence with the knowledge and skills expected to teach these contents of the current ICT curriculum.

However, these and other drawbacks have to be scientifically studied. Hence, the ICT subject syllabi and the above mentioned problems need consideration for the coming revision in line with other countries experience on ICT/IT education. Therefore, this research is motivated to conduct the study in order to identify the major problems and recommend possible solutions.

1.3 Statement of the Problem

ICT is having a profound effect in all corners of the world, and on all peoples. Its effects can be felt in the farthest corners of Ethiopia, as well as in the large cities, as can be witnessed by the spread of mobile phones and Internet cafes all around the country. In addition, to be an active partner in the globalization effect, businesses, government offices, schools, hospitals and many other establishments now require computers which communicate with each other and with the outside world, and workers must be literate.

The new education and training policy of Ethiopia came with new disciplines such as Information Technology for secondary education especially for preparatory program in 2000. Students start ICT at grade 11 and continue in studying it in grade 12 and have been implemented for about four years up to 2003. Over these two years of Preparatory School they used to learn all the major applications software like MS Word, MS Excel, and MS Access.

In 2004, the curriculum of Information Technology was revised with government interest to incorporate new educational approach and technological changes at the first time. But, it has been done without enough need assessment and consideration of other countries experiences. So, this revision was done and limited to personal interest and knowledge of the subject curriculum experts. New topics (contents) were added without any justification and these affected the ICT curriculum very seriously and students couldn't acquire the expected knowledge and skill sufficiently.

In 2006, the National Information and Communications Technology Development Plan was prepared by the then Ethiopian ICT Development Agency (EICTDA). This plan looked forward over the next five years, and considered all aspects of ICT, including an ICT Education sub-plan. The ICT Education sub-plan contains various initiatives, amongst which is the development and implementation of a national ICT syllabi for Grades 1 – 12. The framework for these syllabi was developed over several months by a team working through EICTDA, and finalized in June 2007. This framework was intended to serve as a reference for designing the ICT syllabi for schools. Consequently, it was handed over to the General

Education Curriculum Framework Development Department of the Ministry of Education for the development of the ICT syllabi for Grades 1 – 12. Therefore, all the previous topics (contents) of the syllabi changed for the second time completely [6].

Finally, the government decided to implement ICT curriculum only for secondary school starting from grade 9 because of low ICT infrastructure. But still it has some problems such as naming of the discipline, contents with missing topics, difficulty and relevance of some of the topics, availability of suggested software in the textbook and resources and teachers knowledge and skill, etc. These have brought controversial issues among different ICT related educators in our country. Thus, it is high time to assess how the contents are appropriate and relevant to our concrete situation by comparing other countries experience of ICT education.

1.4 Research Questions

In considering the above ideas, this study will attempt to address the following basic questions:

1. Are the current ICT syllabi relevant and appropriate to Ethiopian secondary schools?
2. To what extent our secondary school ICT curriculum contents are in line with other developed and developing countries?
3. Which knowledge and skills of ICT education students gain at secondary school that help them in the world of work and further study in higher education?
4. What is the status of teachers' qualification and resources available to teach ICT education at secondary schools?
5. To what extent are relevant and appropriate ICT textbook, teachers' guides and reference materials available?

1.5 Objectives

General Objective

The general objective of this thesis is to assess the drawback of the existing syllabi and implementation and recommend the way forward for the future ICT education of Ethiopian secondary schools.

Specific Objectives

The specific objectives of this research are to:

- a. review the secondary school ICT education of different countries in the world,
- b. identify the reasons why ICT curriculum has been under complete (major) change at revision time,

- c. analyze the teachers, students, and ICT related educators' response from the collected data,
- d. evaluate relevance and appropriateness of contents of current ICT curriculum in Ethiopian secondary school by assessing the needs of the country and other countries' experience,
- e. assess the availability of teaching/learning materials such as software, kits, computers, Internet connection, textbooks, reference books, etc.,
- f. assess the preparedness and qualification of ICT teachers to teach the subject, and
- g. suggest the appropriate and relevant contents of ICT education according to other countries experience in the world.

1.6 Methods

In this study, first we will thoroughly study related literature of ICT curriculum experience of other countries. A set of contents will be identified and selected that are relevant to our ICT education. Moreover, we will review related works to ICT education as a subject, learning through ICT and learning with ICT.

A survey will be conducted to collect both quantitative and qualitative data about the status of ICT education in Ethiopian secondary schools. The methodology used to conduct this study such as the study area, the strategy, sampling, plan of data collection and analysis are as follows:

Study Area

The study will be conducted in Addis Ababa where ICT related education is given. It is believed that relevant data can be obtained from instructors and students at the Department of Computer Science and School of Information Science of AAU and ICT teachers of selected secondary schools in Addis Ababa.

Study Design

The study will be carried out through different stages using quantitative and qualitative case study. These stages are preliminary study, main data collection, and data analysis. A general preliminary study through interview, informal discussion, and classroom observation will be conducted. Then we will assess past and present curricula; assess the experience of other countries, and review related literature. The preliminary stage is believed to help the researcher as feedback for the main data collection.

Sampling

Although there are different ICT educators in related fields, the study mainly focuses on private and public university computer science and information system field of instructors and students and from students and ICT teachers of selected secondary schools in Addis Ababa. The schools will be chosen with a purposive sampling technique. Because of planning to

obtain appropriate data, time and financial constraint, sample schools from all Addis Ababa sub-cities are not included. Instructors from selected university/colleges and high school teachers will fill questionnaires and students for the interview and for focus group discussion will be selected with simple random sampling, since all the students have equal and nonzero chance of being selected.

Method of Data Collection

Data will be collected from IT related educators (instructors), high school teachers and students from AAU by asking their attitudes towards the relevance and appropriateness of the topics in ICT subject new curriculum using quantitative and qualitative survey instruments. The instruments to be used will be questionnaire, observation check list, and beforehand prepared questions to focus group discussions to assess their usage and perceptions of the usefulness of the existing IT education, problems on resources, teachers' skill and their opinion on the ICT subject contents.

Data Analysis

After the data is collected, the quantitative data will be tabulated and analyzed using appropriate statistical techniques. The qualitative data will be described in words. Conclusions will be made based on the findings of the analysis.

1.7 Scope and Limitations

The scope of the study is the following;

- To assess the ICT syllabi and its content at secondary school if they are relevant and appropriate to the ICT subject and evaluate if the subject which students learn are to meet the aim set by the education policy and
- To recommend the future content of ICT syllabi for Ethiopian secondary education by considering the needs of the country and experience of other countries in the world.

The study is limited to assessing the impact of ICT education of Ethiopian secondary schools and teachers' knowledge and skills to teach ICT education to study in detail. Due to time and resource constraints, the study will be done only in Addis Ababa.

1.8 Application of Results

ICT education is very essential for economic and social development. Acquisition of computer skills is becoming necessary for employment, educational development, and leisure. Moreover ICT has important role to prepare citizens for the world of work and further studies in higher education.

In our education system, ICT has been given to secondary school students as a subject since 1994. In this thesis work we assess the status of ICT education in Ethiopian secondary schools and compare the relevance of the contents in relation to other countries experience.

The outcome of the study is believed to be beneficial to get attention by the concerned body, to improve the existing ICT curriculum and bring change to the problems on scarcity of resources in ICT laboratories at secondary school. Moreover, the result of the study is believed to be useful for the concerned body to take measure and bring change on ICT teachers' qualification and training. Finally, it will be useful if the problem of ICT education is known by concerned citizen to contribute their part.

1.9 Organization of the Thesis

The remaining part of this thesis is organized as follows. Chapter 2 deals with literature review about the general concept of ICT education, policy for ICT in education, dimension of ICT education, comparison of ICT curriculum among different countries, and some sample model of ICT curriculum. Chapter 3 presents ICT contents linkages in general and tertiary education, ICT teaching in secondary school, curricula and the use of ICT in education and an evaluation of ICT education in England. The research design and methodology such as samples and sampling techniques, data collection instruments and analysis are presented in Chapter 4. The research result and discussion are shown and discussed in Chapter 5. Finally, Chapter 6 deals with conclusions, recommendations and future work of the study.

Chapter Two: Literature Review

A review of literature was made consulting different sources, books and web-sites. This part enabled to ascertain what other authors and scholars have discovered in respect to similar research problems. The purpose of reviewing is to explain concepts about ICT education, policy for ICT in education, dimension of ICT education, comparison of ICT curriculum among different countries, and some sample model ICT curriculum. Hence, conceptual issues on ICT education, ICT education used as an integral tool for learning, goal and objective of Ethiopian national ICT policy, comparison of ICT curriculum among different countries, and some countries experience and model ICT curriculum at secondary school education are briefly reviewed and presented.

Furthermore, it also helps to identify possible theoretical gaps that need to be addressed. The literature review also provides a theoretical approach of ICT education and helps to compare ICT contents of experience of other countries in the world against which the results of the research study enable to improve our ICT curriculum implementation in Ethiopia.

2.1 Introduction

We live in a technological world where Information and Communication Technologies (ICTs) are fundamental to most activities [13]. The importance of ICT in society is emphasized in enabling our future which identifies ICT literate citizens as being central to a country's economic and social goals, to improving productivity and efficiency, and to build innovative capacity and competitiveness.

The ability of individuals to use ICT appropriately to access, manage, evaluate information, develop new understandings, and communicate with others is very important in order to participate effectively in society. These Statements of Learning and the professional elaborations view ICT as an integral tool in the learning process [13]. ICT has the potential to extend student learning capabilities, engaging them in understanding concepts and processes in areas of learning and facilitating change in learning, thinking and teaching. Using ICT as a tool for learning enables students to:

- efficiently and effectively access digital information to assist with investigating issues, solving problems, and decision making.
- produce creative solutions to support learning and develop new understandings in areas of learning.
- communicate, share, and work collaboratively in local and global environments.
- understand the legal, ethical, and health and safety implications of using ICT and their responsibilities as users and developers
- develop new thinking and learning skills to support learning.

The goals of ICT education should not be limited to students' practical activities only, especially in preparation of the students in everyday usage and job. There are teaching-educating-cognition complex goals, which are broader than introducing basic knowledge in Computer Science [13].

New technologies are introduced continually, and the existing ones become obsolete almost as soon as they appear [13]. The rapid evolution of the discipline has a profound effect on ICT education, affecting both content and pedagogy. The general aim of ICT education is to introduce the necessary knowledge, skills, and culture to use and work with information and knowledge for citizens living in the knowledge based society.

ICT education can not cover all the rapid developments in modern Computer Science. Therefore, the goal is to emphasize on general education by presenting fundamentals in Computer and Information Science, providing students with the basic knowledge and skills in exploring different fields of sciences, and preparing them for their future life and role in the knowledge based society.

How can a developing nation consider investments in ICT for enhancing its formal and non-formal education systems when most of its people still live in absolute poverty? This question is discomfoting for everyone concerned with the intersecting issues of ICT and development. However, these interests are not contradictory, and raising the educational level of the poor is a long-term solution toward alleviating their economic problems. The impact of educational level on economic development is more pronounced with the recent growth of ICT and its increasing importance in social and economic development. This has profound implications for education both in how ICTs can be used to strengthen education, and how education can be more effective in promoting the growth of ICT. However, education systems have changed very little in response. Without improved efficiencies in their education systems, developing nations will not likely be able to provide the additional human capital required to achieve economic self-sufficiency in the context of a highly competitive global economy that is increasingly based on the electronic transfer and manipulation of information [13].

2.2 A National Policy for ICT in Education

Information and Communication Technology (ICT) policy, as cited by Olalere [17], can be categorized into vertical, infrastructural, and horizontal policies. Vertical ICT policy addresses sectoral needs, such as education, health, and tourism. The infrastructural aspect deals with the development of national infrastructure and this is closely linked with telecommunication. The horizontal aspect deals with the impact on broader aspects of society such as freedom of information, tariff and pricing, privacy and security.

The Ethiopian Government has made the development of Information and communications technology one of its strategic priorities [6]. ICT in Ethiopia at present is at the early stage of

development. The scope of Ethiopia's ICT policy covers knowledge and information as a tool for development & ICT as a sector or industry. ICT promotes democratic governance by enabling all citizens to participate in the political process as well as have access to global knowledge and information. Thus, the goal of the government is to ensure that all citizens have equal and equitable access to government services and to knowledge and information. Hence, the Government has a commitment to accelerate the development of ICT in order to strengthen the on-going process of sustainable development and poverty reduction as well as good governance and democratic system.

Thus, the focus of the policy is on the following areas that are considered strategic for the success of ICT development [6].

- a) ICT infrastructure development
- b) Human resource development
- c) ICT's legal systems and security
- d) ICT for governance /E-Government/; especially:
 - ICT in the education sector
 - ICT for improved health
 - ICT for agricultural modernization
- e) ICT industry and private sector development
- f) ICT for research and development

When we see specifically the strategy “**Human Resource Development**”, the Ethiopian Government is offering ICT education and training in secondary and tertiary educational institutions with the aim of creating ICT literacy and the basis for the proliferation of ICT professionals in the country. When the ICT development sector gets strengthening, the need for ICT professionals will continue to grow side by side. On top of this, in order to make the community benefit from ICT, it will be appropriate to equip it with basic knowledge and awareness of computer and related technology.

Therefore, Ethiopia's ICT policy assigns a strategic role to ICT Human Resources Development along the following objectives and strategies.

1. Goal

Produce knowledgeable and highly skilled ICT human resources at every level for enabling the country to develop and use ICT.

2. Objectives

- a) To strengthen the government and private institutions offering ICT education and training.
- b) To increase the supply of adequately trained ICT professionals.
- c) To develop basic ICT knowledge of the community.

3. Strategies

- a) Develop and implement short, medium, and long term ICT human resource development plans.

- b) Promote ICT skills development at all levels of the school system with the aim of increasing the supply and diversity of ICT skills, to eliminate the current critical shortages of personnel and to satisfy the expected future growth requirements.
- c) Encourage and provide support to private sector operatives, both in educational institutions and industrial establishments, so as to enable them introduce technology innovations and strengthen the delivery of ICT training.
- d) Identify and aggressively develop the country's ICT human resource requirements in key areas of the economy through focused ICT education and training.
- e) Re-orient electronics engineering and other ICT-related courseware to accommodate new development in ICT for greater responsiveness to the needs of the industry.
- f) Create an environment which is conducive to job creation and satisfaction to minimize brain drain.
- g) Facilitate conducive environment for the expansion of computer education and training in the society.

Similarly, the ICT policy of other African countries like that of Nigeria should be underscored that although as the mission, general objectives, and strategies recognized the importance of ICT in education [17]. Issues relating to education are incorporated under strategic application for Human Resources Development. Under this strategic application objectives 1 to 4 relate to:

- develop a pool of IT engineers, scientists, technicians, and software developers;
- increase the availability of trained personnel;
- provide attractive career opportunities; and
- develop requisite skills in various aspects of IT.

In order to achieve the objectives for Human Resources Development, nine major strategies are outlined. These strategies are targeted at the building of knowledge and skills in information technology [17]. These include:

- a) making the use of ICT mandatory at all levels of educational institutions;
- b) development of ICT curricular for primary, secondary, and tertiary institutions;
- c) use of ICT in distance education;
- d) ICT companies investment in education;
- e) study grant and scholarship on ICT;
- f) training the trainer scheme for National Youth Service Corp members
- g) ICT capacity development at zonal, state, and local levels;
- h) growth of private and public sector dedicated ICT primary, secondary, and tertiary educational institutions; and
- i) working with international and domestic initiatives for transfer of ICT knowledge.

Therefore, information and communication technology is a powerful tool for the development of quality teaching and learning; it is a catalyst for a radical change in the existing school practices and an absolute vehicle for preparing students for the future. Success in the

implementation of an ICT policy will be dependent on the recognition of the importance of strategic application to education and sustainable implementation. Maximizing ICT potentials will involve quality ICT policy, greater involvement of private and public sectors in the funding of the implementation, and proper implementation and monitoring.

2.3 Dimension in ICT Learning

According to Paas [7], there are three separate aspects of ICT in school education: a) Using ICT as a tool to support teaching and learning processes, for example using a word processor, spreadsheet or database in other subject areas such as mathematics or science; b) Learning through ICT where the ICT facility becomes the whole learning environment by providing learning materials, such as LMS (Learning Management System) or Web-based learning; and c) Learning ICT as a subject, that is to say learning the knowledge, concepts, skills, and processes of ICT. Using ICT as a tool and learning through ICT offer very little opportunity for students to learn the knowledge, concepts, and skills needed to master ICT as a subject. Learning ICT is more than the ability to operate and use a computer system. Hence, the acquisition of technical skills is only part of the problems encountered in teaching and learning ICT as a subject. Indeed, ICT education includes a sophisticated set of higher-order skills and cognitive abilities, such as analyzing, designing, implementing, collecting and retrieving, organizing and managing, interpreting and representing, evaluating and creating information.

Indeed, there are a number of issues related to the lack of research in the field of ICT education in schools [7].

1. From the beginning, there have been confusion and disagreements among academics and educators about the theoretical foundations of ICT in secondary education. There are divergent opinions on how to define ICT as a subject, in contrast to ICT as a tool, and as a consequence, there has not yet been found a coherent theory that takes into consideration the manifold aspects of ICT.
2. Despite the emphasis on a set of well-defined topics, the ICT subject curriculum makes few suggestions as to which didactical skills teachers need to acquire in order to teach these topics. In fact, the didactics of ICT is still in its infancy. It lacks the extensive research base of materials published for the didactics of mathematics or science.
3. A major problem for teachers is the complexity of software. While knowledge about the principles and functionality of software is necessary for teaching ICT, it is difficult for teachers to know all the specific features offered by the software packages that they use, because software is continually being developed, extended, and improved.

4. A number of ICT topics are more difficult to teach than other subjects, because they require a much greater range of professional and pedagogical skills than those required to teach a unit of work within a specific subject area.
5. It is not yet clear whether the acquisition of programming skills should be included in ICT education. While programming is a difficult matter for novice students because it requires higher order thinking skills, it is of crucial importance for understanding the nature of computing.
6. Finally, it is not yet clear whether ICT should be a compulsory subject like mathematics or science.

a. Learning with ICT

Swarts [9] discussed that Learning with ICT focuses on teaching and learning in a curriculum context using ICT. Teachers and students use ICT resources to support the classroom curriculum, for example, using tools such as word processing to create written materials, using presentation and authoring software to present projects, using drawing and painting software to enhance work in visual arts.

In certain ways, learning with ICT may be perceived as a natural integration of ICT with existing classroom processes. Thus ICT can be used interchangeably with tried and trusted teaching and learning methodologies. Learning with ICT also supports learning, through the use of „practice“ type software to reinforce concepts already learned, or to access digital encyclopedia or other resources. Thus, learning with ICT not only supports self directed learning by affording students enhanced opportunities to select individual paths to learning, but can also make learning meaningful and contextualized.

b. Learning through ICT

Learning through ICT may automatically include learning with ICT, but it focuses on teachers“ and students“ use of ICT to engage with the curriculum in ways that would not previously have been possible without ICT [9]. Learning through ICT results in more authentic learning experiences for teachers and students. Previously, students could access certain level of resources and materials at first hand, but much classroom learning was achieved through explicit experience. In cases where the real or actual experience is out of reach, ICT offers another dimension, which is virtual. For example, using the Internet, students in classrooms can now access live data from NASA (which supports the curriculum in science) and have the same opportunities to analyse data as real scientists. Students can engage in virtual „field trips“ in space, back in time or within the human body. A group of students could meet the goals of their history curriculum/syllabus by engaging in local historical research using online databases and archive records, and create a web page or other creativities as learning outcomes.

c. Learning ICT as a Subject

In the study of ICT as a core subject for all, students will need to acquire the knowledge, skills, values and attitudes to use ICT to communicate, handle information, model and control [9]. They will develop key ICT skills in a range of applications including: word processing, computer graphics, databases, spreadsheets, email, Internet, presentations, video/animation and web authoring. Students learn ICT practical skills, but they also learn to consider wider issues such as adapting their work according to the audience, and they learn about the ethical issues as well as the dangers associated with technologies, e.g., Internet safety. These skills and topics are normally the same over successive years of study, but are taught in a spiral of increasingly more challenging demands and in an age appropriate manner.

IT as a subject in high schools is normally designed to prepare students for the practical use of technology and to stimulate their interest in the use of computers. The subject usually includes integrated career exposure/exploration components, which provide career awareness and prepare students for entry level positions. Depending on how the subject is structured, students will gain the foundation for further technology training (either in the workplace or at tertiary/further education levels) and will be prepared for entry-level work experiences.

Generally, IT is offered as a subject in most countries of the world; it focuses on activities that deal with the solution of problems through logical thinking, information management and communication. As such, the subject will enable learners to understand the principles of computing through the use of current programming language, hardware and software, and how these apply to their daily lives, to the world of work and to their communities. The following learning areas are normally covered by high school IT syllabi [9]:

- Hardware and system software, i.e., an understanding of hardware and the system software that is needed to make the hardware operational.
- e-Communication – developing an understanding of electronic communications. This includes the legal, ethical, social, political and moral aspects of access to information and data protection.
- Social and ethical issues - the reasons for using computers and the effects of their use across a range of application areas.
- Programming and software development – the design, implementation, testing and delivery of efficient and effective solutions to problem situations is studied. Thus object-orientated programming languages, databases, spreadsheets, websites and their interconnectivity will be used in the design and implementation of solutions to specific real life problems.

2.4 A Comparison of ICT curricula among different countries

Kargiban and Kaffash [8] described that ICT now plays an important role in the curriculum of England, Malaysia, America, Canada, India, and China. It is not only taught as a discrete subject but is also a useful tool for other subjects in the curriculum. However, ICT as a subject discipline in Malaysia and China is more or less different compared to its characteristics in the National Curriculum for England, America, India, and Canada. The ICT curriculum of the six countries is structured in different way with some condition. The curriculum of China and Malaysia is formed in a behaviorist way while that of England, America, India, and Canada are based on constructivist theory. Behaviorism is more concerned with behavior than with thinking, feeling, or knowing. It focuses on the objective and observable components of behavior. Behaviorists look at learning as an aspect of conditioning and will advocate a system of rewards and targets in education. Also, the ways of teaching and learning, assessment and evaluation of ICT teaching in each country showed many differences. Due to a relatively long time of teaching using behaviorist theory and the broad use of examination method for assessment, teachers in China and Malaysia are sometimes reluctant to apply constructivist approaches in teaching. Constructivism is basically a theory based on observation and scientific study, about how people learn. It says that people construct their own understanding and knowledge of the world, through experiencing things and reflecting on those experiences. Teachers in the United Kingdom, America, India, and Canada are more likely to use constructivism in teaching with ICT. Reasons for these differences may vary from cultural diversities to government policies. Consequently, the ICT for England is based on National curriculum and has been better structured than other countries, if we ignore the different background in other countries. When we mentioned constructivist learning, it seems superior in comparison to the behaviorist one. But, Malaysia and China have reasons for choosing the behaviorist way of curriculum structure though it is simple because teachers and students got used to it.

Kargiban and Kaffash [8] compared ICT curriculum structure of England and America which have a constructivist theory background. But, the curriculum structure of England in each subject includes the key stage, and the programs of study set out what pupils should be taught; and the attainment targets set out the expected standards of pupils' performance [9]. It is up to schools to choose how they organize their school curriculum to include the programs of study. ICT tools are used to find, use, analyze, interpret, evaluate and present information for a range of purposes. The key skills in the National Curriculum include: 1) information-processing skill; 2) reasoning skill; 3) enquiry skill; and 4) creative thinking skill and evaluation skill.

The key skills include the ability to make critical and informed judgments about when and how to use ICT for maximum benefit in accessing information, solving problems or expressive work. The ability to use ICT sources includes the enquiry and decision making skills, as well as information-processing and creative thinking skills and the ability to review,

modify and evaluate work on ICT. Opportunities for developing these key skills are provided explicitly through the subject of ICT and through pupils' use of ICT across the curriculum.

The curriculum reform in China is based on the policy of quality improvement at all levels derived from two policy documents, "The Action Scheme for Invigorating Education towards the 21st century" and "Decision on the Deepening of Education, Reform and the full promotion of quality education". The focus is on modernization, the world and the future with the aim of preparing the younger generation with appropriate morality, intellectual accomplishments, awareness of one's responsibility towards oneself and the nation, independent personalities and lifelong learning [10]. In China, the secondary school is called Middle school and is divided into junior middle school and senior middle school. In junior middle school ICT education begins from year 7 to 9, and senior middle school education from year 10 to 12. The aims for junior middle school are mainly: 1) ICT definition understanding; 2) computer skill; 3) using information to support studying; 4) basic information assessing and evaluating; and 5) ethical issues about ICT. The aims for senior middle school include: 1) handling information on the web; 2) applying communication technology in everyday life; and 3) understanding basic programming theories. The teacher uses Internet as a medium of teaching [10].

The Malaysian government is now seen to restructure the education system into one aimed at educating students to achieve all knowledge and skills necessary to function in an ethnically diverse world. A system of lifelong learning will be promoted to ensure that workers can continuously upgrade their skills and knowledge in order to remain relevant in the environment of the rapidly changing technology and work processes, as well as to nurture a learning society. The concept of ICT in education, as seen by the Ministry of Education of Malaysia, includes systems that enable information gathering, management, manipulation, access and communication in various forms [8].

The concept of Smart School revolves around the notion of using ICT as one of the tools that support and enhance the teaching-learning process. In the Smart School, technology is used for the following purposes: 1) as an information processing and productivity tool; 2) to enhance professional development; and 3) to automate instruction [8]. The Smart School is also widely considered as a tool to initiate responses to the need for Malaysia to make the critical transition from an industrial economy to a knowledge base economy. The curriculum content emphasizes the integration of knowledge, skills and values. The knowledge to be acquired in the ICT curriculum consists of concepts and facts about ICT, as well as ICT terminology. It includes procedures in managing computer systems, sequential processes in developing products, and programming commands and syntax.

Also the skills involved are communication skills, information management skills, managing computer systems and problem solving skills. Teaching and learning approaches and strategies are important for achieving the learning objectives set out in the curriculum. The

teacher acts as an instructor or a facilitator, depending on the type of activities and the learning outcomes. Task-based activities are almost completely student centered. Here, the teacher's role involves: a) providing advice on project management procedures and task organization; b) monitoring the progress of student projects; c) giving advice, tips and recommendations whenever needed; and d) evaluating the outcome of students' work. Learning strategies include the Self-Directed, Self-Accessed, Self-Assessed and Self-Paced strategies.

According to Paas [7], while there is a huge research literature on the field of ICT as a tool in teaching and learning, there is much less research on the area of ICT as a subject or similar designations such as school informatics. As a result, there is a lack of theoretical grounding of the didactics (profession of teaching) of ICT and associated teaching and learning processes. One of the main reasons for the lack of theoretical underpinnings of the didactics of ICT is that there have been in the past and persist even now strong disagreements and confusion about the nature of ICT as a school subject. While the content of the subject has been clearly defined in the school curriculum, the didactics of ICT is still unclear.

The Canadian ICT subject curriculum from 2006 is intended to improve the content of the subject, on the one hand, and to enhance the teaching and learning of ICT, on the other hand [7]. Unfortunately, the curriculum is restricted to what is to be taught (content) and makes few suggestions as to what didactical skills teachers need to acquire in order to teach ICT as a school subject. Hence, despite a clear specification of content, ICT lacks a disciplined approach to didactics. The lack of a coherent framework for the didactics of ICT makes it difficult to identify which didactical skills teachers need to acquire in secondary schools, which learning strategies are efficient to construct knowledge, and which assessment approaches are adequate to assess the students' learning.

In some countries reviewed, ICT as a subject is taught in secondary schools with contents like hardware and system software, email, Internet and Internet safety, application software, computer graphics, video/animation and web authoring, social and ethical issues and some programming and software development.

2.5 A Model Standard ICT Curriculum for Middle and High Schools in Jordan

With the rising growing youth population, the Jordanian government has to ensure that the quality of education and level of skills imparted can help the new generation to compete effectively in the national and international arena [28].

The Ministry of Education developed highly advanced national curriculum and many other nations in the region have developed their education system using Jordan as a model. Jordan ranks number one in the Arab World in education. The Jordanian Ministry of Education is now making it mandatory for students to be computer literate and able to apply their studies in

computers to their regular studies, most especially the scientific and mathematical courses. Its educational system is of international standards and its secondary education program is accepted in world-class universities. Students in secondary school level are required to take 9 subjects; computer study is the one from these subjects [28].

There is a three level specification that covers the requirements of Information and Communication Technology (ICT). It provides opportunities for students to develop an awareness of the nature and importance of Information and Communication Technology in a rapidly changing society, and enables students to develop their application of knowledge, skills and understanding of Information and Communication Technology [28].

The assessment of candidates includes both practical capabilities using Information and Communication Technology and the knowledge and understanding which underpins this capability.

The ICT curriculum is split into three levels: introductory, intermediate and advanced. At each level there is the specification itself, the objectives which a student is expected to attain and some suggestions as to how these objectives might be met.

The target for the following specification is [28]:-

- grades 7 and 8 – introductory with age 12-14,
- grades 9 and 10 – intermediate with age 14-16,
- grades 11 and 12 – advanced with age 16-18.

The success of the specification can be measured in many ways such as the students taking and passing a universal standard examination such as the European Computer Driving License and the International Computer Driving License.

No specific software titles or hardware manufacturers have been mentioned throughout the specification. Any type of software and computer can be used as long as the requirements of the specification can be met. The grades and ages given above are a guide only. There is no age or time restriction on students who follow this specification. There are sections in the advanced level (problem solving using IT) designed for the student to solve and document a problem in ICT.

The specification has many areas where the students can gain practical knowledge of computers. However some institutions may lack hardware and may have to cover some of these topics theoretically. The specification assumes three hours per week at each level with approximately 90 hours over a one-year period. Two hours can be used for learning the subject and the third hour can be used for applications that students can do in different subject areas such as languages, art, history, geography or mathematics utilizing the different skills as they are acquired. Obviously, this will depend on the human and physical resources available within the institution [28].

The Overall Specification of contents in Jordan ICT curriculum [28]

(1) Introductory Level

- What is a computer?
- Basic input and output devices
- Basic storage of data and managing files
- Introduction to email and the World Wide Web
- Organizing data
- Nature of information and IT in society
- Word processing
- Handling images and sound
- Data handling
- Logo
- IT applications in everyday life
- Independent learning and managing a computer

(2) Intermediate Level

- Computer systems
- Input and output devices
- Storage devices and media
- Communications
- Data
- Legal issues, implications, health and safety
- Word processing, desktop publishing and other presentation software
- Graphics
- Spreadsheets, modeling software and data handling
- Programming, control and data logging software
- Information systems and applications

(3) Advanced Level

- Programming
- Data
- Problem solving using IT
- Word processing, desktop publishing and other presentation software
- Spreadsheets, modeling software and data handling
- Networks

The unit order is left to individual schools to make decisions depending on available resources and other time tabling constraints. The overall objectives are made clear for each of the three levels – Introductory, Intermediate and Advanced.

The institution will need a suite of computers for the students which could be arranged as a network but need not be. Access to the computers at any time is advisable so that students can continue with their work out of lesson time. In order for the students to do work on the Internet and to send email, they will need computers which have this facility. In order to do any of the control or data logging work there will need to be equipment available either for the students to use or for demonstration.

In order to follow this specification, students will need to have access to: word processing software, desktop publishing software, presentation software, spreadsheet software, data-handling software, control software and hardware, data logging software and hardware, graphics software and communication software.

Teachers of specific units at the three levels will need to be proficient in the specific subject area they are teaching. They will need a good knowledge of the software that is being used for a specific unit.

2.6 ICT Curriculum Experience of Botswana

The world is becoming connected electronically by the Internet, the world-wide network through which we can all share information. As is clearly stated in Vision 2016 it is the intention of Botswana to become a commercial centre within Southern Africa as part of a global network and its populace will require the necessary ICT skills to enable this goal to be achieved [27].

The Education Policy of Botswana aims to prepare Botswana for a transition from a traditional agro-based to an industrial economy. In a fast growing economical environment, entrepreneurship is a major vehicle for both development and job creation and students will be encouraged to explore how the use of computers can benefit society as a whole. The industrial economy world-wide is driven by ICT, which uses computers to process, analyze and communicate information in an increasingly efficient and effective way. Thus any developing industrial society must have a high level of computer literacy within its workforce who would then be capable of fully exploiting the opportunities made possible by ICT [27].

The syllabus is geared towards students who are in senior secondary school and is designed to equip them with knowledge of computer skills, the applied use in the world of work, and a background for further training. It includes theoretical and practical content in hardware, software, communication and data processing.

The subject will foster an interest in, enjoyment of, and confidence about the use of computers that will encourage the development of problem solving, analytical and research skills. On completion of the subject, students will have the ability to use computer skills and techniques as a problem-solving tool [27].

The ICT main themes selected to teach in senior secondary school are:

- Computer hardware and software
- Computer applications (monitoring and control system, Artificial Intelligence and other applications)
- Social and economic implication of the use of computers
- System development life cycle (problem, objective, costs and benefits and data gathering techniques)
- Programming concept (structured programming techniques, algorithms using pseudo code and low level and high level language)
- Data and file management (data and information and file organization)
- System and communications (network, communication media and device, real time system and operating system)

2.7 Tanzanian ICT Academic Syllabus for Secondary Education Diploma

The subject will be conducted in two years of study. It is a compulsory subject with the intention of developing Information and Communication Technology (ICT) skills in student teachers as well as upgrading their academic knowledge for further studies. The mode of learning will involve theoretical and practical aspects in the participatory mode [29].

The subject emphasis is on two main aspects; namely ICT as a subject for technological advancement and second, as a tool for facilitating the process of teaching and learning at Ordinary level Secondary Schools.

ICT Subject Goals

The goals of this subject are to [29]:

- a) Develop knowledge, skills and positive attitude in the use of technology;
- b) Develop mastery of ICT knowledge to become competent and committed professionals
- c) Develop ICT skills to protect Tanzanian culture
- d) Empower student teachers to use ICT for social-economic changes.

Competences to be developed

By the end of the course student-teachers should have ability to:

- a) Demonstrate skills in the use of ICT in education.
- b) Process, interpret and disseminate information.
- c) Create computer programs
- d) Design and develop websites.
- e) Use ICT in bringing about the development of the society.

Objectives of the ICT subject

By the end of the course student-teachers should be able to [29]:

- a) Acquire knowledge and skills in the use of information and communication technology in education;
- b) Use ICT knowledge and skills to foster development of the society
- c) Demonstrate skills of processing, interpreting and disseminating information;
- d) Implement programs using programming languages;
- e) Acquire knowledge and skills to design and publish website
- f) Appreciate the role of Information and Communication Technology in socio-economic and cultural development of the society.

The subject contains seven topics, namely

- **Fundamentals of Information and Communication Technology,**
 - ✓ Information
 - ✓ Communication
 - ✓ Technology
- **Computer and networks,**
 - ✓ Computer Architecture (Input, processing, storage and output parts of computer, function of each part of the computer, Connect computer peripherals)
 - ✓ System software (types of operating systems, features of operating system, basic operations of operating system, function of utility programs)
 - ✓ Computer Handling (Manage the computer room, user account, antivirus and other utility programs)
 - ✓ Computer Networks (Concept, computer networks layout, computer networks components, network configurations, computer network software)
 - ✓ Internet (Concept, Search information from internet, Evaluate information from the internet, Communicate using Internet.)
- **Generic Software Applications,**
 - ✓ Word processor (concept, create a word processing document, Apply advanced features of word processing)
 - ✓ Spreadsheets (Concept, create worksheet, advanced features of spreadsheet)
 - ✓ Presentation program (Concept, Create presentation, apply presentation)
 - ✓ Database (Concept, plan and design a database structure, create database, apply)
- **Computer Programming Language,**
 - ✓ Concept of programming Language (concept, types, the programming life cycle)
 - ✓ Developing a program (select appropriate programming language, Identify data structure, function, array and string)
- **Websites Design,**
 - ✓ Website development (concept, website structure, create website)

- ✓ Publishing website (Outline steps of publishing web pages, Publish a website, Update the website)
- **Multimedia**
 - ✓ The concept of multimedia (concept, elements of multimedia, analyze types of multimedia)
 - ✓ Multimedia presentation (forms of multimedia, forms of multimedia presentation, design multimedia)
 - ✓ Application of Multimedia (areas of application, design)
- **Socio-economic and Cultural aspect of ICT**
 - ✓ Impacts of ICT in the society (other Information and Communication Technologies apart from computer; different application areas of ICT, impact of ICT in the society)
 - ✓ E-learning (concept, steps on develop e-content)

2.8 ICT Curriculum Experience of UK

The importance of information and communication technology (ICT) is to prepare pupils to participate in the rapidly changing world in UK where work and other activities are increasingly transformed by access to varied and developing technology. Pupils use ICT tools to find, explore, analyze, exchange and present information responsibly, creatively and with discrimination. They learn how to employ ICT to enable rapid access to ideas and experiences from a wide range of people, communities, and culture. Increased capability in the use of ICT promotes initiative and independent learning, with pupils being able to make informed judgments about when and where to use ICT to best effect, and to consider its implication for home and work both now and in the future [26].

In England, Scotland, Northern Ireland and Wales, there are national strategies covering training measures and research projects for ICT in schools, e-learning, e-inclusion, and digital/media literacy and e-skills development. There are central steering documents in the United Kingdom for all ICT learning objectives at primary and secondary education level, except for using mobile devices and using social media, (although these are both covered in Scotland, where developing programming skills is only mentioned at secondary level). Using social media is mentioned at primary level in England, Wales and Northern Ireland, and in Wales using mobile devices is referenced at secondary level. In primary schools ICT is taught as a general tool for other subjects/or as a tool for specific tasks in other subjects, is also included within technology as a subject in Scotland and England, and is taught as a separate subject in England. In secondary schools, ICT is taught as a general tool for other subjects/or as a tool for specific tasks in other subjects, included within technology as a subject and taught as a separate subject in England, Wales and Northern Ireland [26].

ICT can be used to find, develop, analyze and present information, as well as to model situations and solve problems. ICT enables rapid access to ideas and experiences from a wide range of people, communities and cultures, and allows students to collaborate and exchange information on a wide scale. ICT acts as a powerful force for change in society and citizens should have an understanding of the social, ethical, legal and economic implications of its use, including how to use ICT safely and responsibly. Increased capability in the use of ICT supports initiative and independent learning, as students are able to make informed judgments about when and where to use ICT to enhance their learning and the quality of their work [26].

The syllabus is accredited for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate. University of Cambridge International Examinations is the world's largest provider of international education programmes and qualifications for 5 to 19 year olds. The curriculum content is set out in eight interrelated sections. These sections should be read as an integrated whole and not as a progression [30]. The sections are:

1. Types and components of computer systems
2. Input and output devices
3. Storage devices and media
4. Computer networks
5. Data types
6. The effects of using ICT
7. The ways in which ICT is used
8. Systems analysis and design

Candidates should be familiar not only with the types of software available and the range of ICT knowledge and skills detailed, but also with their uses in practical contexts. No marks will be awarded for using brand names of software packages or hardware. As ICT is a subject that is constantly developing, marks will be awarded for relevant answers which relate to new or emerging technology that has not been specified in the syllabus [30].

2.9 Summary and Implication

2.9.1 Summary

Information and Communication Technologies (ICTs) are fundamental to most activities today and ICT literate citizens as being central to a country's economic and social goals, to improving productivity and efficiency, and to build innovative capacity and competitiveness.

Different countries of the world develop ICT policy to bring development. Our country Ethiopia produced ICT policy with a goal to ensure that all citizens have equal and equitable access to government services and to knowledge and information within this policy. Human resource development strategy of this policy has an aim of creating ICT literate with basic knowledge and awareness of computer and related technology. Therefore, ICT is a powerful tool for the development of quality teaching and learning; it is a catalyst for a radical change in the existing school practices and an absolute vehicle for preparing students for the future.

In literature there are three separate aspects of ICT learning in school. These are: learning with ICT (using ICT as a tool to support teaching process), learning through ICT (where the ICT facility becomes the whole learning environment by providing learning materials, such as LMS (Learning Management System) or Web-based learning); and learning ICT as a subject (that is to say learning the knowledge, concepts, skills, and processes of ICT).

The reviewed literature showed that ICT curriculum is geared towards students who are in secondary school and is designed to equip them with knowledge of computer skills, the applied use in the world of work, and a background for further training. It includes theoretical and practical contents in hardware and system software, computer application, information processing, system and communication, social and ethical issues (reason and effect of using computer), data and file management and programming concepts.

2.9.2 Implication

In research tradition, the implication of consulting review of literature, among others, is to examine the current knowledge and gaps between researches done before and a research underway. Furthermore, it helps an investigator to have a deep knowledge about his research topic.

ICT education is necessary for development and countries designed national ICT policy. With human resource development strategy, the ICT education is given in school to bring ICT literate citizen for the modern world. But the countries should fulfill ICT resources and qualified teachers to train students appropriately at every level.

Accordingly, an attempt has been made to review some countries experience of ICT curriculum to equip secondary school students with knowledge of computer skills. But, these countries ICT curriculum have much similarity and some difference in their ICT contents.

The review work asserted that there is no research carried out directly on learning ICT as a subject in different countries. As it is expressed in related works in the next Chapter, researches have been so far done on linkage of ICT in different level and evaluation of ICT in school education. In addition, the review indicated that ICT education is critical for development of the society. But, preparing standard ICT curriculum alone is not enough. Attention also should be paid to the fulfillment of ICT resources and quality ICT teachers at schools.

Chapter Three: Related Work

In this Chapter, different works which are related to the study of ICT education curriculum for secondary school are presented. The papers presented are not only on studies of how ICT education is given in secondary school rather different studies on the integration and impact of ICT in education are also selected and presented based on the relevance and the similarities of the papers with this thesis work.

3.1 Evaluation on ICT Education Contents Linkages in General and Tertiary Education of Mongolia

According to Sambuu and Lxagvasuren [11] the framework of curriculum development standards of Mongolia indicates the ICT education content linkage in general and tertiary education. The study shows how the contents of the ICT Curriculum Standard are implemented in secondary schools. This survey is carried out in randomly selected 46 secondary schools (12 of them from rural area). ICT curriculum of all schools comprises basics of computer, Windows operating system, text processing (Microsoft Word), multimedia presentation (Microsoft PowerPoint), and spreadsheets (Microsoft Excel) according to the contents of the ICT Curriculum Standard.

The authors also confirmed that the ICT subject knowledge and skills defined in information and information technology domains are fully offered to the students. Curriculum of most schools includes Internet usage (95.6%), Image Processing (91.3%), Algorithms (86.9%), Networking (89.1%), and Modeling (91.3%). Information/Information systems (65.2%), Information Culture (21.7%) and Computer and Information Ethics (34.7%) are not included widely. Standard contents such as service applications and databases are not included in the curriculum in all 46 schools. Few schools still offer non-standard contents: Programming (30.4%), Web Technology (15.2%) and Publishing (17.3%). Regarding programming the survey shows that schools use Programming languages such as C++ and Pascal.

From the survey on ICT Curriculum, it can be concluded that implementation of the ICT contents standard is not satisfactory in secondary schools and there is still a gap between urban and rural schools. Especially in this time of rapid development of ICT having great impact in daily life and its broadened usage, it has become vital to build up ethical norms of handling with computers and information. It is extremely low scale that the content of computer and information ethics was studied by 34.7% of the surveyed schools (16.7% of rural schools, 41.2% of urban schools), while the content of information culture was studied by 21.7% (16.7% of rural schools, 23.5% of urban schools) and the content of information and information system was studied by 65.2% (25% of rural schools, 79.4% of urban schools). It also shows that curriculum coverage of contents of information domain is not in same level in urban and rural schools.

3.2 A Theoretical Framework for the study of ICT in schools of Singapore

Lim [16] showed that a socio-cultural approach towards the study of ICT in schools rejects the view that ICT can be studied in isolation, or as a single variable in the learning environment holding all other things constant.

The research was carried out in two phases. Phase one comprises of a self-reporting questionnaire to be sent out to all schools in Singapore. One of the main objectives of the questionnaire is to assess the level of ICT integration in schools by identifying the various socio-cultural elements that influence the successful integration of ICT in schools. The other objectives are to serve as a screening phase to identify the case studies for phase two of the study, and to refine and guide the direction of phase two of the study. The questionnaire explored different aspects of ICT integration in schools that include school ICT culture (leadership support, exchange of ideas and experiences, and extent of staff involvement in review of school ICT program), pupil use of ICT (proficiency of pupils in the use of ICT and pupils' usage for learning), teacher use of ICT (teachers' proficiency in the use of ICT and integration of IT by teachers in the classroom), management of ICT resources (accessibility to ICT resources and monitoring process of ICT resources to optimize usage) and staff development (opportunities for staff development in the area of ICT integration and review of staff development to meet the needs of ICT integration).

Phase two is a collective case study of schools at different levels: primary schools, secondary schools and junior colleges. The sample of schools at each level is chosen based on their degree of ICT integration reported in phase one. Case study research is the most appropriate methodological tradition, given that the purpose of the study emphasizes the context of ICT use. To gather accounts of different realities constructed by various groups and individuals in different environments, both qualitative and quantitative methods are drawn upon: observations of ICT and non-ICT based lessons, face-to-face interviews with principals and ICT-coordinators, focus group interviews with students and teachers, questionnaires for teachers and students, and samples of students' work and schools' documentation.

Finally, the finding showed that a sociocultural approach towards the study of ICT in schools rejects the view that ICT can be studied in isolation; it must be studied within the learning environment and the broader context in which it is situated. The paper has argued for a more holistic approach of studying ICT in schools by adopting a sociocultural perspective. It proposes a theoretical framework based on the activity system as a unit of analysis that is surrounded by different levels of ecological circles.

The study confirmed that the process of ICT integration in Singaporean schools reached a considerable level of maturity and stability. It emphasizes how policymakers, school administrators and teachers can take up the opportunities and address the limitations of ICT,

and how to successfully integrate ICT in schools, specifically within their broader sociocultural contexts.

3.3 Curricula and the use of ICT in Education: Two Worlds Apart?

In this study of Tondeur *et al.* [14], the link between national curricula and the use of ICT in primary education has been explored. In particular, the study has pointed out the relative importance of a national ICT curriculum in the context of a decentralized educational system. Although the results in this study cannot be generalized beyond the target population of Flemish (part of Belgium) primary schools, the study can inspire states and regions where a similar incongruence is being observed between ICT-related national curriculum initiatives and the current level of adoption of integrated ICT use. From the research findings, it is concluded that the aspirations of national educational authorities in view of establishing ICT competencies does not automatically result in changes in classroom practices.

Curriculum frameworks can even be in conflict with the characteristics of the local school system (e.g., school policy, school culture and teacher beliefs). The findings also suggest that teachers have hardly been involved yet with regard to the integration of ICT competency frameworks. Analysis of the interviews with the principals indicates lack of communication between school principals and teachers concerning the implementation of ICT in the school. The development of a school-based ICT plan that translates nationally defined ICT-competencies in terms of school-based operational objectives is presented as a more promising approach. The development of an ICT plan gives stakeholders the opportunity to reflect on their particular educational use of ICT.

Within this dialogue, the following questions can be explored: How can the framework for ICT competencies be implemented and tested in classroom practice? What feedback can be derived from classroom practice? What type of feedback is considered critical from a classroom perspective? They indicated that in the future, in-depth studies are needed to identify in more detail how teachers respond to ICT curricula, how this is related to their education conceptions and to what extent contextual factors at school level (e.g., ICT policies and school plans) can be identified as determinants of the use of ICT in the classroom. In these follow-up studies, the balance between centralized and decentralized factors should be stressed.

3.4 ICT in Secondary School of England

The survey by NASUWT [12] sought to get a view of existing practice in schools and to get teachers' and school leaders' views on whether schools might seek to teach the ICT curriculum. The survey asked if ICT teachers worked with other departments to jointly plan and assess ICT in other areas of the curriculum. The overwhelming majority of respondents (88%) reported that ICT teachers did not work with other departments to plan and assess the

ICT curriculum. Just 12% of respondents indicated that ICT teachers do work with teachers in other departments. Of these, more than three-quarters (82%) said that their school does not allocate specific additional time for joint planning and assessment.

Therefore, NASUWT [12] described that in most schools, cross-curricula approaches to delivering the ICT curriculum would appear to create additional workload burdens for staff. Respondents were asked for their opinion about how application of the ICT Programmes of Study and Attainment Targets would impact on ICT teaching across the school curriculum in the future. Just over a third of respondents (42%) said that they thought that the change would lead to an increase in ICT being taught through other subjects. Forty-six percent said that they thought there would be no change. Focusing on the amount of time for teaching ICT as a subject, almost two-thirds of respondents (63%) said that they thought that the plans to teach the ICT curriculum would lead to a decrease in the amount of teaching time allocated to ICT.

Other evidence from a survey [18] has shown that innovative and challenging uses of ICT can improve pupils' data-handling skills, and their ability to construct complex models. Clearly the subject of ICT is a special case because it is essential that both practical skills and theoretical knowledge are developed. The research shows that if teachers provide opportunities for pupils to carry out in depth investigations with appropriate modeling environments then they can reach higher levels of abstraction and competency in the field of ICT.

There is evidence to show that the use of simulations can enhance pupils' reasoning and decision-making and enquiry skills, and that use of ICT can enhance pupils' understanding of specific historical and geographical topics such as erosion and agriculture. There is very little evidence of ICT being used or evaluated in primary schools for the teaching of history and geography, and clearly this is an area of the curriculum where more ICT use and research is needed [18].

Although few national studies have been conducted in the UK to investigate the effects of a range of ICT resources on attainment, there are many research studies into specific aspects of ICT, which have produced useful results. A recent study of over 100 IT co-ordinators in England, found that less than 10% of the ICT teachers were using anything other than word processing more frequently than once a month, despite the broader and deeper requirements of the ICT curriculum. The ICT curriculum covers using simulations, building computer-based models, analyzing data, measuring and controlling experiments and communicating information. As discussed above, there is much evidence to show that simulations can contribute to learners' understanding of science. For the ICT curriculum, some of the concepts and processes are similar to those in science that is, hypothesizing relationships, exploring models of real and imaginary situations and evaluating the effectiveness of computer simulations. Simulations can present different representations on the screen compared with those provided by more traditional resources.

Evidence from these studies [18] has shown that the way ICT is organized within the school setting can have a large impact on the effects of ICT on pupils' attainment. For example, in secondary schools most of these studies involve teachers using networks of computers, an electronic whiteboard, or a cluster of computers. These specific uses have shown that in the case of networks, teachers usually prepare an activity beforehand, then during the lesson act as a facilitator. In primary schools, many studies continue to report the use of a few stand-alone computers shared between 30 pupils in a class.

Finally, there is a growing body of research into pupils' use of the Internet for sending and receiving emails, for using chat rooms, and for creating websites. Researchers have therefore analyzed the text of emails and websites to assess pupils' development of new ways of communicating their ideas and presenting information.

3.5 Summary

This chapter reviewed different related research works on ICT education. One evaluation shows the implementation of the ICT content standard is not satisfactory in secondary school in Mongolia. The study shows implementation gap between urban and rural schools to teach content standards. This content standard has five content domains: Information, Computer, Algorithm, Model, and Information Technology. In addition, having percentage of standard contents is very important to implement standard ICT curriculum for evaluating how ICT contents are implemented properly at school level in Ethiopia. Therefore, this experience is a lesson provides us to prepare the contents of the ICT Curriculum Standard that the Ethiopian secondary schools should follow.

The other related work showed that ICT education can be given with two approaches like integration at primary school and as a subject in secondary school in different countries of the world. The study showed a socio-cultural approach towards the study of ICT in schools rejects the view that ICT can be studied in isolation, or as a single variable in the learning environment holding all other things constant. This confirmed that the process of ICT integration in Singaporean schools reached a considerable level of maturity and stability. It emphasizes how policymakers, school administrators and teachers can take up the opportunities and address the limitations of ICT, and how to successfully integrate ICT in schools, specifically within their broader socio-cultural contexts.

Another related research works in England, found that less than 10% of the ICT teachers were using anything other than word processing more frequently than once a month, despite the broader and deeper requirements of the ICT curriculum. The ICT curriculum covers using simulations, building computer-based models, analyzing data, measuring and controlling experiments and communicating information. There is much evidence to show that simulations can contribute to learners' understanding of any subjects. For the ICT curriculum, some of the concepts and processes are similar to those in other science that is, hypothesizing

relationships, exploring models of real and imaginary situations and evaluating the effectiveness of computer simulations. Therefore, this related work indicates the way ICT is organized within the school setting can have a large impact on the effects of ICT on pupils' attainment in England.

Chapter Four: Research Design and Methodology

4.1 Procedure of the Study

This study was carried out through different stages using quantitative and qualitative case studies. These stages were preliminary study, main data collection, and analysis.

A general preliminary study through interview, informal discussion and observation was conducted during the first stage. Likewise related literature was reviewed. The preliminary stage helped the researcher as feedback for the main data collection. For example, how the discipline of ICT is given at secondary school with appropriate qualified teachers, what are the difficulties teachers face in the teaching learning process and in what extent computers and resources are sufficient at school ICT laboratories. In addition, when did schools start to implement the new ICT curriculum? This helped to know which grade level of students have a sufficient opinion to evaluate the strength and weakness of the new curriculum content and teachers' knowledge and skill to teach the subject.

The research participants were selected purposefully, which is searching for those who could provide reliable information both with questionnaire and focus group discussions. As a result, a total of ninety university instructors and secondary school teachers and one hundred twenty students participated in the preliminary, main data collection using questionnaire and in the in-depth Focus Group Discussion (FGD) based on their willingness and appropriateness of giving reliable information.

English and Amharic were used during the FGDs. Observation using check list in the real classroom teaching, ICT laboratories and students practice of real computer laboratory setup were done.

Finally, the data obtained from the FGDs, questionnaires, and classroom observation check list were organized, categorized, summarized, concluded and reported in the last two Chapters.

4.2 Study Area

The study was conducted in Addis Ababa from a total of four government and private universities where ICT/IT related education is given, and from selected ten secondary schools. The secondary schools were selected using purposive sampling technique out of the ten sub-cities in Addis Ababa. The rationale to use this technique was that most schools which have qualified ICT teachers are more important to get necessary information to the research. The researcher secured the list of the schools in the respective five sub-cities because of time and financial constraints. In addition, because of expecting similar situations in most schools around ten sub-cities in Addis Ababa.

4.3 Population

The population of this study was secondary school ICT teachers and students who participate in the IT/ICT teaching learning process. In addition, instructors and students from private and public universities/colleges who are teaching and learning in ICT/IT related fields were involved.

4.4 Selection of Key Participants

Participants were involved in the study from ten secondary schools, 100 students for FGDs from grades 11 and 12 and questionnaires were given for 57 teachers. In addition, 20 first year students participated in FGDs from two public universities/colleges and 36 instructors with questionnaire from two public and two private universities/colleges. All in all 213 participants were involved in the study. But out of 93 questionnaires, 2 are missed from public university instructors and 1 is missed from one secondary school. Hence, a total of 90 questionnaires were collected from participants.

All secondary schools and universities were taken purposively. Nevertheless, students available were taken using sampling technique for the following reasons. First, 11 and 12 grade students know the new ICT curriculum content starting from grade 9. Second, first year students at the university know the old ICT content and can give information about their secondary school education drawback when they learned the subject. For these basic reasons, the researcher was forced to take the participants who were able and willing to be involved.

The number of teachers and students from secondary schools and university/college instructors and students involved in the study are provided in Tables 4.1 and 4.2 respectively.

Table 4.1: Secondary School Participants of the Study

No.	School Name	Sub-city	Teachers	Students	Remark
1	Addis Ketema	Addis Ketema	8	10	Public
2	Minlik II	Arada	10	10	Public
3	Yekatit 12	Gullele	9	10	Public
4	Meskayie Hizunan	Gullele	2	10	Private
5	Tikur Anbesa	Arada	4	10	Public
6	Bole	Bole	9	10	Public
7	Kokebe Tsbah	Yeka	7	10	Public
8	Holy Trinity Cathedral	Yeka	2	10	Private
9	W/o Kelemework	Gullele	4	10	Public
10	Radical Academy	Arada	2	10	Private
	Total		57	100	

Table 4.2: University/College Participants of the Study

No.	University/College	Department	Instructors	Stds FGD	Remark
1	AAU	Computer Science	7	10	Public
2	AAU	Information Science	8	10	Public
3	Microlink	Computer Science	11	-	Private
4	CPU	Information Tech.	10	-	Private
	Total		36	20	

4.5 Instruments/Tools

“The purpose of a survey is to use questionnaires or interviews to collect data from the participants in a sample about their characteristics, experience and opinions” [22]. Hence, questionnaires, interviews, checklist, and general observation guide were utilized to secure the data.

From Borgdan and Biklen [19] perspective also, data gathering approaches in qualitative case study can be effective interviews, careful observation and document analysis. In addition Wellington [20] mentioned that Focus Group Discussion (FGD) is also a complementary technique to collect data in a qualitative case study.

Therefore, for this study the data was gathered using questionnaire, focus group discussion and class observation check list (real classroom).

4.5.1 Questionnaire

Two types of questionnaires were developed in English: one set of questionnaire for the university instructors, and the other set for secondary school ICT teachers. The main reason to use questionnaire was for obtaining factual information, opinions and attitudes from large number of subjects within a short period of time. The questionnaires had the nature of semi-structured. That is both types of questionnaires included sets of questions which are closed and semi open questions. See Annexes 1 and 2 for the details. The content of the questionnaire for university instructors included:

- General background of the instructors (sex, qualification, experience, level they teach, total number of years he/she taught the subject)
- Evaluation of the drawbacks and relevance of the change on the previous and current versions of IT/ICT curriculum contents
- General opinion on the major change made from the previous version of IT curriculum

- Which knowledge and skill of information and communication technology should students gain and develop at secondary school in their opinion
- How university instructors evaluate the relevance and appropriateness of the current ICT content at secondary school
- To select inappropriate and irrelevant ICT contents that teachers are unable to teach from the current ICT curriculum of secondary school
- What is their opinion on the name of ICT with their justification
- What is their observation the undergraduate course given at University level enable ICT teachers to teach the ICT contents in high school without any additional training?
- If they feel undergraduates need training or orientation (inservice training), in which main contents teachers need training to fill their skill gap to teach effectively the ICT subject?

Similarly, the questionnaire for secondary school ICT teachers consisted of:

- General background (sex, qualification, experience, level they teach, total number of years he/she taught the subject)
- How teachers evaluate the relevance and appropriateness of the ICT contents they teach
- Evaluation of the drawbacks and relevance of the change between the previous and current versions of IT/ICT curriculum contents
- General opinion on the major change made on the previous version of IT curriculum
- Ask their opinion if students have interest to learn ICT or not
- What is their opinion on the name of ICT with their justification
- Availability of resources like software, computers and Internet infrastructure at school
- Problems related to development of the new ICT textbooks and teachers' guides and availability of reference material at secondary school
- ICT difficult contents that teachers unable to teach at secondary schools
- If teachers have taken any training or orientation, how helpful the training/orientation was/is in enabling them teach the ICT subject effectively
- If teachers did not take any training/orientation, ask them to specify the type of training/orientation they need to fill their skill gap to teach the new ICT subject effectively

4.5.2 Classroom Observation Checklist

A checklist was employed to support the data obtained using the other instruments. It included items which could help to check the appropriateness of the teaching learning process and practice in practical application in ICT Laboratory session, availability of computers, Internet

connection and recourses like kits for teaching and troubleshooting in school labs, and the condition of the teachers' qualification for ICT in the school. Based on the items, the researcher rated the aforementioned points.

Therefore, the study used observation results as one of the main sources of data. The observation was carried out without specific observation procedure. The observation areas were:

- In the classroom, when the normal teaching/learning process was going on.
- Instructor's support during practical application of computer laboratory sessions.

From all what have observed those which seem relevant to the study have been recorded for analysis purpose. Later on, related ideas were grouped in the same category for the analysis purpose.

4.5.3 Focus Group Discussion

Focus group discussion was conducted both with students at secondary school and universities/colleges to answer the basic questions of the research. This is because making a discussion among individuals (more than two) may provoke individuals mind to generate more ideas and to make an exhaustive argumentation among each other [20].

The study utilized FGD to obtain stronger, well discussed, and versatile information since opinions of many individuals are better than opinions of a single individual. Hence, ten students were involved in one FGD discussion. The relevant discussion was recorded and discussion guiding questions were used in order to minimize loss of information.

Interview (discussion) items for students comprise (see Annexes 3 and 4 for a checklist):

- How students evaluate ICT class and contents in their secondary school
- Asses if they have interest to learn the subject
- Opinion about old and new curriculum at their secondary school ICT education
- Contents which are difficult for them to learn
- Sufficiency of computers, software, kits for troubleshooting and reference materials to learn ICT
- Student evaluation of teachers' knowledge and skill to teach ICT in secondary and preparatory level separately
- If teachers' lack knowledge and skill and in which contents teachers face difficulty to teach ICT
- Students opinion on the major strengths of the subject
- Their opinion on the new textbooks and the major problems related to development of the new textbooks

- Their opinion if secondary school ICT education is beneficial for their field of study in the university
- Solutions they suggest to resolve/fix some of the problems in the ICT teaching learning process

4.6 Procedure

Construction

All the tools were prepared in English. But the FGD questions were presented and opinions agreed by the group were collected in Amharic. This was done intentionally in order to avoid communication barriers on the part of the participants. Finally, based on the comments given, some rearrangements were done on the tools.

Validation

A pretesting was conducted in two secondary schools, namely Minilik II and Yekatit 12 preparatory schools, which are located in Arada and Gullele Sub-cities. The schools were selected randomly out of the sample of ten secondary schools. The piloting involved four teachers and ten students. All students in both schools were taken as participants using purposive sampling. The four teachers were taken for the pretesting without applying sampling technique.

The two types of instruments, the teachers' questionnaires, and students FGD, were piloted. The purpose of the piloting was to check content validity, readability, and estimate the time needed to accomplish both instruments by the participants. Hence, the following results were identified in the course of tryout of the instruments. Two items in the teachers' questionnaire were not complete content wise, and there was a need to add one additional item. In the students' FGD tool, one item was found lacking clarity and incomplete content wise. Concerning the time needed to fill in the questionnaires, no problem was identified; they were completed within the expected time.

Administration

All the tools were administered by the investigator in person. Teachers and students were briefed about the objective of the study and the procedures to fill in the questionnaires. Finally, the tools were collected by the investigator after their completion.

With respect to the FGD, first the investigator arranged appointments with the participants to conduct it. Accordingly, the FGD were held at every school classroom in different days.

4.7 Data Analysis

Qualitative data analysis is a complex process that involves back and forth between concrete ideas of data and abstract concepts between inductive and deductive reasoning and between description and interpretation [21]. Bordgan and Biklen [19] have shown that data analysis in qualitative studies basically involves word argumentation rather than numerical explanation.

The data collected through questionnaire and observation checklist were tabulated and analyzed manually. Data obtained through FGD which is in Amharic were translated to English. The translation is done by the researcher. After the data gathered through FGDs were examined, they were categorized in line with their similarities which served to put related issues together in such a way that the data are on the basis of the research questions. Rationality of the data was achieved using triangulation methods by comparing students' perspective, instructors' perspective and researcher's observation perspective of events. Finally, conclusion was made based on the result of the analysis.

Chapter Five: Results and Discussion

5.1 Results

This Chapter describes the major findings obtained in terms of the major themes related to the specific objectives and research questions.

As it is pointed out earlier in this thesis, the purpose of this study is to assess the status of the existing secondary school ICT curriculum and suggest the way forward for future ICT curriculum in Ethiopian secondary schools by also considering the experience of other countries. To investigate the major issues related to the research questions and specific objectives, quantitative and qualitative data have been collected and analyzed.

Accordingly, data were collected from different sources between July 2013 and Oct 2013. Questionnaires, FGDs (Focus Group Discussions), and classroom observations were used for each of the key participants: students and instructors. Hence, this Chapter deals with the analysis and the results of the data collected. Some of the data secured by using questionnaires were analyzed using percentages, while other data gathered via questionnaire, observation check list, and FGD were analyzed qualitatively.

The findings and discussions of the study are organized around nine themes. These themes are:

1. Condition of current secondary school ICT curriculum
 - Name given to the subject
 - Contents of the current ICT curriculum relevance and appropriateness to Ethiopian secondary schools
2. Perception on the major changes made on the previous and current versions of ICT contents
3. Whether students have interest to learn ICT at secondary school
4. ICT knowledge and skills students should gain and develop at secondary school
5. Difficult ICT contents teachers are facing to teach from the current curriculum
6. Availability of resources like hardware, software, and Internet connection at secondary schools
7. Major problems concerning development of ICT textbook and availabilities of reference materials
8. The condition of ICT teaching learning process and ICT laboratory facilities
9. Practical application of theoretical lessons in the ICT laboratory.

5.1.1 Description of the Selected Sample Secondary Schools

Table 5.1 shows the names of the sample secondary schools in Addis Ababa, years of establishment, the sub-city they are located and number of ICT teachers in the schools.

Table 5.1: Description about year of establishment, sub-city and no. of ICT teachers

No.	School Name	School type	Sub-city	No. of ICT teachers
1	Minlik II Preparatory	Public	Arada	10
2	Yekatit 12 Preparatory	„	Gullele	9
3	Kokebe Tsibah	„	Yeka	7
4	Addis Ketema	„	Addis Ketema	8
5	Radical Academy	Private	Arada	2
6	Bole Preparatory	Public	Bole	9
7	Holy Trinity Cathedral	Private	Yeka	2
8	W/o Kelemework	Public	Gullele	4
9	Tikur Anbesa	„	Arada	4
10	Meskayie Hizunan	Private	Gullele	2

As depicted in Table 5.1, the schools were selected with purposive sampling technique which does have grades from 9 up to 12 to obtain the necessary data. In fact the total number of schools in Addis Ababa is 190 in 2004 E.C. Because of time and cost constraint we selected only 5% of them. The year of establishment of majority of sample public secondary schools range from 30 to 110 years. However, few of the sample private schools their establishment is less than 15 years. In addition, numbers of ICT teachers in public schools range from 4 to 12 with respect to large number of students but the private schools have only 2 teachers for the four levels of students from grades 9-12.

5.1.2 Background of the Participants

Data collection instruments (Questionnaires) were distributed to 36 university instructors from two private and two public institutes. Out of these two were missed. In addition, 57 teachers from ten secondary schools filled the teachers' questionnaire where 51 were from public and 6 are from private schools. But one is missed with teacher personal reason. Some of the relevant personal information of participants is provided in Table 5.2.

Table 5.2: Background of the participants

Factor	No. of University Instructors	%	No. of Secondary School Teachers	%
<u>Experience in years</u>				
1 – 5	11	32	24	43
6 – 10	16	47	17	30
11+	7	21	15	27
<u>Qualification</u>				
Diploma	–	–	1	2
BSc	9	26	54	96
MSc	23	68	–	–
PhD	2	6	–	–
Others	–	–	1	2
<u>Field of specialization</u>				
Computer Science	25	74	14	25
Information Science	8	24	23	41
Computer Engineering	1	2	2	4
Information Technology	–	–	17	30

Most of the participants’ teaching experience in the study was below 10 years. And few of them have above 11 years of teaching experience. When we come to their educational level, more than two third of the university instructors have MSc in Computer Science/Information Science. One third of the university instructors and 96% of the secondary school ICT teachers have BSc in Computer Science/Information Science. In addition, few of the university instructors hold PhD in Information Science. However, some 4% of the secondary school ICT teachers have diploma and other qualifications.

5.1.3 Condition of Current Secondary School ICT Curriculum

The study assesses the condition of current ICT curriculum with respect to three aspects: whether the name of the subject ICT is appropriate or not, participants’ rating of the relevance and appropriateness of the current curriculum and which contents of the current curriculum are relevant to students of secondary schools of Ethiopia.

a. The name of the subject ICT which is used at secondary schools

The participants were asked whether they agree with the current name given to the subject ICT at secondary school or not? Table 5.4 shows the percentage of respondents in agreement and in disagreement.

Table 5.3: Participants’ opinion regarding the name of the subject ICT

Do you agree with name ICT for the subject	Yes	No
University instructors	27 (80%)	7 (20%)
Secondary school teachers	45 (81%)	11 (19%)

As indicated in Table 5.3, most (80%) of the participants of the university instructors and (81%) secondary school ICT teachers are in favor of the name ICT to the subject but some considerable number of them university instructors (20%) and secondary school ICT teachers (19%) disagree with the name ICT for the discipline.

Reasons why respondents disagree with the name ICT to the subject

- ICT has a broad meaning, so it is better to teach students in a good notation (use a more specific name appropriate to the subject).
- The curriculum lacks communication and networking components.
- ICT is a broad term that encompasses all sorts of communications and devices such as computer and computer networks. So, it will be better to use “**Computer and its Applications**”.
- ICT is a broad term and very deep. We can use “**Introduction to Computers**”.
- ICT is an umbrella term but we are implementing IT.
- Since ICT holds information and communication together, it is not an appropriate name for the subject.

b. Contents of the current ICT curriculum relevance and appropriateness to Ethiopian secondary schools

University instructors’ and secondary school teachers’ opinion regarding the relevance and appropriateness of the current content of ICT education in secondary school was also assessed as shown in Table 5.4.

Table 5.4: Relevance and appropriateness of contents of current ICT curriculum

Respondent	Very good	Good	Medium	Poor	Very poor
University instructors	–	20 (59%)	9 (26%)	5 (15%)	–
Secondary school teachers	6 (11%)	38 (68%)	12 (21%)	–	–

Most of the university instructors (29, 84%) said the contents are good and medium to secondary school and some considerable number (5, 15%) of them said the contents are poor. In addition most secondary school teachers (38, 68%) rated the ICT curriculum as good. Some (12, 21%) of them said the contents are medium and (6, 11%) of them rated it as very good.

The university instructors and secondary school teachers had been provided with a questionnaire to select the relevance and appropriateness of contents in the current ICT curriculum. Table 5.5 shows total number of participants in percentage who reacted on the relevance in line with the contents/themes for secondary schools ICT curriculum.

Table 5.5: Relevance of contents of the current ICT curriculum

Contents	Relevant	Irrelevant
Introduction to ICT	90 (100%)	–
Application Software	89 (99%)	1 (1%)
Information and Computer Security	42 (47%)	48 (53%)
Exploring the Internet	24 (27%)	66 (73%)
Basic Troubleshooting	71 (79%)	19 (21%)
Control and Learning with Logo	13 (15%)	77 (85%)
Image Processing and Multimedia Systems	34 (38%)	56 (62%)

.Most of the respondents (79% and above) said that contents such as Introduction to ICT, application software and basic troubleshooting are relevant to secondary school ICT subject. Likewise, nearly half (47%) of the respondents agree to teach information and computer security at introduction level as presented in the curriculum. But most of respondents said the other contents like Exploring the Internet (73%), Control and Learning with Logo (77%) and Image Processing and Multimedia Systems (62%) are irrelevant according to the feasibility and concrete situation of the country.

One ICT teacher said that he prefers to teach in ICT class contents like Introduction to ICT and application software (word processing, spreadsheet, database application and publishing software) only because of lack of training and resources.

Generally, most of them suggested that it is better to teach only basic computer knowledge like introduction to ICT and basic application software. Because the current curriculum contents don't consider students background and are beyond students' grade level and expressed that they are dissatisfied with most of the contents.

5.1.4 Perception on the major changes made on versions of ICT curriculum contents

The researcher asked about perception on the major change made on the previous and current versions of ICT curriculum. Most University instructor respondents (30, 89%) opinion showed that each successive version contains the contents of the previous version and includes its own new contents. The previous version was on how to use user applications only and too generic (it needs to cover topics related to computer hardware and software concepts). But the current version is good because it is associated with many ICT topics and covers the basic knowledge and skills required and concentrated more on the fundamental concepts of ICT. Though they have doubt on the time available to cover and needs proper scoping. In addition, topics like image processing and multimedia systems are advanced related to the other topics. It needs enough number of experts in the area and very serious consideration should be given for availability of hardware & software. Computer security without networking is difficult to give a clear understanding for students and also the topic on control and learning with Logo should not be necessarily included as content. However, adding basic troubleshooting and exploring the Internet was the best decision made.

Some other University instructors (18, 54%) responded that the current version is very good and tries to have more features of ICT as an introduction for secondary school students but the negative side is that in most parts of our country to teach these concepts is a very difficult task for the teacher and it may be challenging for the government to fulfill the necessary ICT infrastructures, software and computers in schools.

One university instructor respondent said that “the current version seems ambitious, if students could learn these, they benefit more. However, given the reality, it is very hypothetical. It may work particularly for Addis Ababa secondary schools. Otherwise it is very unrealistic to think that it works elsewhere in the country.” Even students coming to university don’t seem to possess the necessary capacity and don’t have sufficient knowledge and skills to operate a PC (personal computer). Generally, contents seem relevant but it is difficult to get qualified teachers as well as properly equipped computer laboratory.

Therefore, most of them (89%) said that contents are relevant in the first and second version but are not sufficient to equip students with expected ICT knowledge and skills at secondary schools. But the current version is adequate and need scoping.

5.1.5 Do students have interest to learn ICT at secondary school?

Secondary school teachers were asked whether students show interest to learn the ICT subject. And if students are not interested to learn the subject, what is the reason behind that? The result is shown in Table 5.6.

Table 5.6: Student interest to learn ICT subject

Do students show interest to learn ICT?	Yes	No
Secondary school ICT teachers	39 (69%)	17 (31%)

Most of the teachers (69%) said that students have interest to learn ICT with some constraints. But one third of them (31%) responded that students don't have interest to learn ICT.

The reason given why students don't have interest and don't give attention to learn ICT are

- They are forced to give much attention to those subjects which appear in national examinations only.
- The private school students know more about computer at lower grade levels and most contents are repetitions for them. Therefore, they have no interest to attend.

5.1.6 ICT knowledge and skills students should gain and develop at secondary school

University instructors were asked about which ICT knowledge and skills students should gain and develop at secondary school. Most of them (31,92%) said that students at this level should develop basic computer skills to operate, acquire some theoretical knowledge about ICT, and becoming competent in using the Internet which are enough for secondary school students. But in order to go beyond the mentioned ones and upgrade our contents so as to meet other countries experience as a standard becomes a very difficult task since our limited resources don't allow to include other contents.

Some respondents (16, 46%) have different opinion on what students should learn. They said that students should learn basic computer knowledge in addition to some important knowledge and skills like data handling to help them in the world of work and to continue with their study at higher education. Therefore, contents should go in line with other developing and developed countries in the world.

The suggested contents are listed below:

- How to work on windows environment (windows operating system)
- Basic computer manipulation and hardware and software issues
- Data representation skill
- Information system and social media tools
- Learn how the modern computer works
- Basic computer troubleshooting, assembly and upgrading
- Problem solving and some basic programming concept
- Introduction to ICT, computer and its application such as word processing and spread sheet

- Basics of networking (introduction to computer networking and other communication networks)
- Internet and how to get service provided over the Internet
- Computer care and safety
- Basic web page design and database
- Basic application of ICT in real life

5.1.7 Difficult ICT contents teachers face to teach in the current curriculum

a. ICT Contents difficult to teach in secondary school

University instructors and secondary school ICT teachers were asked to respond on contents and subtopics which are difficult to teach in our secondary schools. In addition the study asked to specify their reasons as to why contents are believed to be difficult to teach. However, most of the ICT teachers (74%) didn't give any comment on the content called control and learning with Logo because they don't know of nothing about the content.

Some of the teachers who teach in grades 11 and 12 in words responded that:

“We prefer to teach some of the contents like Introduction to ICT, Information and computer security, and application software only. But basic troubleshooting, Exploring the Internet, and image processing and multimedia system are difficult to teach because of lack of software, Internet connection and other resources.”

Table 5.7 shows the percentage of University instructors and secondary school teachers who claimed those contents which are difficult.

Table 5.7: Difficult contents from the current ICT curriculum

Contents	No. participants claimed difficult to teach	
	Sec. school Teachers	University Instructors
Exploring the Internet	47 (84%)	-
Basic troubleshooting	8 (15%)	15 (44%)
Image processing and multimedia system	48 (86%)	28 (82%)
Control and learning with Logo	26 (46%)	30 (89%)
Information & computer security	-	2 (6%)

Most of the secondary school ICT teachers (above 80%) claimed that Exploring the Internet and image processing and multimedia systems are difficult to teach in secondary school ICT subject. On the other hand, nearly half (46%) of them responded that Control and learning

with Logo and few of them (15%) responded that basic troubleshooting is difficult. Likewise, most university instructors (above 80%) responded that image processing and multimedia systems, and control and learning with Logo are difficult. But few of them claimed that basic troubleshooting and information & computer security contents are difficult.

b. Reasons given for contents considered difficult to teach

Secondary school teachers were asked the reasons why contents are considered to be difficult to teach ICT at secondary school. The given reasons and the respective number of teachers are shown in Table 5.8.

Table 5.8: Reasons given for the contents to be considered difficult to teach

Reason	No. teachers who consider as a reason
Lack of training	25 (44%)
Lack of computers	41 (73%)
Lack of Internet access	52 (92%)
Lack of software	30 (53%)

As shown in Table 5.8, the majority of respondents (92% and 73%) felt that the reasons why contents are difficult are due to lack of Internet access and lack of computers, respectively. Some of them felt that the reason for difficulty is (44% and 53%) lack of training and lack of required software, respectively.

Generally, some schools tried to solve the problem of resources by their own initiative, writing letters for NGOs (non government organizations) and donors to support the school by funding for the provision of computers, software and also establishing Internet infrastructure. But, most schools tried to implement the curriculum without any support from the responsible government sectors.

5.1.8 Availability of resources like hardware, software and Internet infrastructure

According to school computer laboratory observations, out of 10 sample secondary schools, seven of them are public schools and totally don't have Internet access and the required software to teach ICT. But the rest three private secondary schools are equipped with the necessary software and infrastructure to teach ICT. Table 5.9 shows computer student ratio and availability of software and Internet access at sample secondary schools obtained from school ICT laboratories observation.

Table 5.9: Computers, software and Internet connection at computer laboratories

Name of school	Computer student ratio	Software	Internet access
Minlik II Preparatory	1:4	Not available	Not available
Yekatit 12 Preparatory	1:10	Not available	Not available
Kokebe Tsbah	1:4	Not available	Not available
Addis Ketema	1:10	Not available	Not available
Radical Academy	1:2	Available	Available
Bole Preparatory	1:4	Not available	Not available
Holy Trinity Cathedral	1:1	Available	Available
W/o Kelemework	1:4	Not available	Not available
Tikur Anbesa	1:7	Not available	Not available
Meskayie Hizunan	1:2	Available	Available

When we see computer student ratio, 85% of the schools showed that the ratio is in between 1:3-1:6 and especially 10% of them private schools is in 1:2 ratio. But 5% of public schools computer student ratio is beyond 1:6. In addition, as shown on Table 5.9, there is no Internet access in all public schools. But the private schools provide Internet access and software to teach the contents of ICT curriculum.

5.1.9 Problems on development of ICT Textbooks and availability of reference materials

The new ICT textbooks are distributed to students for borrowing until the grade level academic year completed. The student textbook ratio at public and private secondary schools is in between 1:3 to 1:5 and students will return back the textbooks to school after the academic year ended.

Most teachers and students at secondary schools agreed that the textbooks are characterized with problems such as irrelevant expansions of ideas like using unnecessary long sentences, recommend using software which are not available and leave the use of software without enough steps to understand the application and learn the content, etc. Table 5.10 shows teachers responses on the availability of reference materials.

Table 5.10: Availability of reference material at schools

Do teachers get ICT reference material at schools?	Yes, I get many	Yes, I get some	No, I don't get
Secondary school ICT teachers	5 (9%)	16 (29%)	35 (62%)

Table 5.10 shows availability of reference material as indicated by teachers. Most of the teachers (62%) said that they don't get any reference material in their school libraries and 29% of them said that they have got some reference material about old application software. This evidence indicates there are no relevant reference materials around school libraries that support ICT education in secondary schools. Teachers and students don't have opportunity to enrich their ICT knowledge and skills by using additional reference materials apart from the knowledge they acquire by using the basic application software like MS Word, MS Excel, MS Access and MS Publisher.

However, 9% of them who have Internet connection said that they have got many reference material about ICT. This indicates in some schools teachers have an Internet access and try to browse information and documents related to ICT.

5.1.10 The condition of ICT teaching/learning process and ICT laboratory facility

To assess the teaching and learning process and to see whether ICT laboratories facilities were in place, the condition of ICT sessions in schools were evaluated using observation check list while the teaching learning process in ICT class was taking place. This helps the research to triangulate with the problem of implementing the ICT curriculum in secondary school. Some criteria were selected for assessing while teachers were giving lessons and assisting students in laboratory for practical sessions. These criteria are the teachers' subject matter knowledge, clear presentation, methods used to teach, ability of teachers to respond to students' questions, and encourage students to participate for understanding. The lesson was rated using a checklist.

Two teachers are evaluated in every school when they were giving theoretical lesson and assisting practical application ICT laboratories. It can be seen that the teaching learning process in most schools (95%) is unsatisfactory. Because most school teachers don't apply active learning approach (like brain storming question, group work), their presentation lacks different methods of teaching techniques (question and answering, summary etc). This shows teachers need in-service training in pedagogy science. Few of them (5%) are better use the class properly by applying different methods of teaching that allows students actively participate in the lesson.

As teachers and students apparently indicated every school has problems in ICT resources. In addition, the school observation similarly indicated that ICT laboratories facility is not good.

The computers provided have low processing speed and low memory capacity. Some of the computers do not function well, and totally no internet infrastructure exists in most schools.

5.1.11 Practical application of theoretical lessons in computer laboratory

The practical application of ICT theoretical lesson in computer laboratory was assessed. Table 5.11 shows the number of students entered at once at ICT laboratory and practical application of theoretical lesson at sample schools according to the computers and resources seen in ICT laboratories at schools and teachers' ability to support students.

Table 5.11: Practical application in computer laboratories

School name	No. of Student in ICT laboratory at a session
Minlik II	50
Yekatit 12	65
Kokebe Tsbah	65
Addis Ketema	65
Radical Academy	30
Bole Preparatory	60
Holy Trinity Cathedral	35
W/o Kelemework	50
Tikur Anbesa	70
Meskayie Hizunan	35

Table 5.11 shows that in most schools ICT laboratory number of students entered at one session is between 50 –70. This big number of students appeared in all sample public schools. This shows the laboratories at school and the number of students is not proportional even to see the practical application in group. However, in the rest three sample private secondary schools, the number of students in ICT laboratory is less than 40. This helps teachers to easily implement practical application sessions and allow students to practice.

5.1.12 Result of students FGD

Discussion points about ICT curriculum contents, availability of ICT resources at schools, students' interest to learn ICT, contents which are difficult to learn ICT and teachers' knowledge and skills to teach ICT were presented for discussion to a maximum of ten students at each of the ten secondary schools and two public universities for FGDs (see annex 3 and 4). The following results were obtained after the discussion.

Students were asked to evaluate the contents of ICT subject in their secondary school. Most of them said that they couldn't say anything about the contents because they simply come to ICT

class to fulfill the regulation of the school. In addition, they follow what the teachers told them and they don't know seriously the contents from their textbook. Some students said that most contents are good. However, because of lack of resources and lack of teachers' interest, there are many contents which they don't learn at ICT class. Even they finish the semester without covering the contents for each grade.

All public schools students said that they like and have interest to learn the subject ICT but with different reason as to why they don't give attention to study and put an effort to know more about ICT. One of their main reasons that obliged them not to give attention is that the subject doesn't appear at national examination and hence are forced to give more time to other subjects that appear in national examinations.

Most public school students agreed that ICT laboratories don't have sufficient resources like computers, software and Internet connection. Because of this big problem, they said that they couldn't acquire and develop the required knowledge and skills of ICT. Even teachers mostly teach by selecting topics that are simple to present in class.

Students were asked about the teachers' knowledge and skills to teach ICT contents. Most students agreed that teachers have knowledge and skill to teach ICT but some said that teachers select contents and teach without any difficulty but they couldn't say confidently about their knowledge.

In FGDs most students couldn't identify contents which are difficult to learn and for teachers to teach. However, some students from public and private schools identify contents which are difficult to learn because of lack of resources. These contents are Exploring the Internet, Control and learning with Logo and Image Processing and Multimedia Systems.

All students unanimously agreed that the development of textbooks is very poor. Some contents are simply written with irrelevant ideas. Some topics about application software don't clearly specify with the necessary steps to practice in practical sessions. Students were asked about reference material, but in FGD all students don't give time to refer other reference material and no assignments/group works forced them to go to libraries for referring and gain additional knowledge about ICT.

Students at FGDs were asked to suggest their opinion to resolve the problem in ICT teaching learning process and improve future curriculum of ICT. They listed the following points:

- The Ministry of Education and regional educational bureaus should give attention to equip schools with required ICT resources
- Contents are not covered every year with different reason and should be reconsidered by the concerned body
- The ICT subject should be part of the national exam to get attention by students

- Textbooks should be developed clearly and properly with concepts and steps to use software that help especially at practical work.
- Teachers leave schools in short time for better job and a solution should be found to retain them at least until the year is completed
- Give additional training when teachers are employed at first time

Refer to Annexes 3 & 4 FGD questions of secondary schools students and 1st year computer science/information science students.

5.2 Discussion

In this Section focus was made only on major selected issues in order to avoid redundancy. The issues were examined in light of the literature.

5.2.1 Qualification of ICT teachers in schools

The strength of any educational system largely depends on the quality and commitment of its teachers. The teacher is the most important resource in an education system in any society [23]. The teacher also plays a major role in the delivery of quality education. Educational quality has been shown to be largely a function of teachers' quality. In Ethiopia, as per the education and training policy, a secondary school teacher should at least have a first degree [23].

The qualification of ICT teachers in the selected sample secondary schools is very important to evaluate whether ICT education is properly implemented. In the study, the result indicated that in the sample of 10 secondary schools in Addis Ababa, most of ICT teachers' educational level is first degree in Information Technology and some with diploma and other qualification like certificate which is less than diploma.

As the educational statistical annual abstract 2004/05 E.C shows, from a total of 2474 teachers in Addis Ababa, 2031 teachers (82.1%) are qualified for the level. The available statistics however indicates that the proportion of qualified secondary school teachers varies from region to region to a large extent but except Dire Dawa and Addis Ababa the percentage of qualified teachers in other regions are less than 60% [24].

This implies that the literature and the investigation agree on there is a problem on ICT teachers' qualification to implement the contents. This shows that especially regions don't have enough number of qualified teachers to teach ICT contents and most of the current curriculum content is very challenging to implement at secondary schools. Therefore, the Current ICT curriculum couldn't be implemented without qualified teachers and needs serious attention to resolve this problem.

5.2.2 Availability of Computers, Software, and Internet

Availability of resources like software, computers and Internet is very essential to teach ICT contents in secondary school. But, teachers unanimously indicated that there is lack of resources to teach ICT and mostly they skip those contents that require Internet connections and special software. Similar idea was obtained from students FGD and school ICT laboratories observation and showed that every school ICT laboratory, particularly that of public schools laboratory is in place without the required computer memory and capacity, software and Internet connection. Even most computers that are found in the school ICT laboratories are not functional. Refer to Annex 5: ICT lesson and laboratories observation checklist.

In most of the school computer laboratories observed, students were seen to be crowded around each computer more than eight students in some cases. This shows ICT education is given without any practical application in almost every school. This implies that if schools don't have sufficient resources for computer laboratories, the contents couldn't be implemented properly. This indicates to reconsider our ICT curriculum as the availability of software and Internet access is very poor in most schools as shown in the findings and needs serious support and supervision by the concerned body.

5.2.3 ICT knowledge and skills students should gain and develop at secondary schools

ICT focuses on activities that deal with the solution of problems through logical thinking, information management and communications. As such, the subject will enable learners to understand the principles of computing through the use of current programming languages, hardware and software, and how these apply to their daily lives, to the world of work and to their communities [9].

The following learning areas are normally covered by high school IT syllabi [9]:

- Hardware and system software, i.e., an understanding of hardware and the system software that is needed to make the hardware operational.
- E-Communication – developing an understanding of electronic communications. This includes the legal, ethical, social, political and moral aspects of access to information and data protection.
- Social and ethical issues - the reasons for using computers and the effects of their use across a range of application areas.
- Programming and software development – the design, implementation, test and delivery of efficient and effective solutions to problem situations. Thus object-orientated programming languages, databases, spreadsheets, websites and their interconnectivity will be used in the design and implementation of solutions to specific real life problems.

This study revealed that university instructors suggested the following ICT knowledge and skills students should gain and develop at secondary schools:

- How a modern computer works and skills like basic computer manipulation and hardware and software issues,
- Information system and social media tools,
- Basic computer troubleshooting, assembly and upgrading,
- Problem solving and some basic programming concepts like basic web page design,
- Computer and its applications such as word processing, spreadsheet and data representation skills,
- Basics of networking (introduction to computer networking and other communication networks),
- Internet and how to get service provided over the Internet,
- Computer care and safety,
- Basic application of ICT in real life.

The finding in this study shows that the contents suggested by university instructors and that are dealt with the current ICT curriculum are not far away from the contents reviewed in the literature. However, it was found out that some contents from the current ICT curriculum are not feasible to our country concrete situation and better give prioritize to other contents indicated in the reviewed literature. This implies that our current ICT curriculum needs some sort of revision by considering our country schools situation and other countries experience.

5.2.4 Practical application of theoretical lessons in computer laboratories

Computer laboratories typically provide focused activities that direct students' exploration. Moreover, students working in laboratories have the benefit of discussing their ideas and problems both with other students and with the instructor. These opportunities do not exist in lectures or while working on standard homework assignments [25].

One cannot consider the use of laboratories independent of the relationship between a laboratory experience and the lecture session that drives it. We identify five variables that govern the relationship between lecture and laboratory [25].

- Articulation type: how the laboratory component is used
- Models of the content level: what is being taught
- Activity type: what the students are doing
- Types of interaction: how the students and teachers interact in the laboratory activities
- Learning objectives: the level of mastery to be achieved by doing the laboratory exercise

The interaction between these variables governs the effectiveness of the laboratory activities. After discussing each variable, we will begin to outline how the variables interact. The latter activity is by no means a definitive analysis. Instead it is recommended that individuals use

these variables as a basis for determining whether they believe a particular laboratory activity, or a sequence of laboratory activities will be relevant to the theoretical session [23].

On the one hand, the research showed that most public schools have big class size. Teachers face challenge to implement practical application of theoretical lessons, because of big class size but they try to help students to acquire knowledge and develop skills of ICT by giving group works and help each other with minimal number of computers.

Moreover, teachers and students opinion similarly indicated that schools don't have a capacity to implement the current ICT curriculum because of insufficient laboratory resources and few numbers of laboratory rooms. Teachers select contents which don't require resources that don't exist in school laboratories. This shows that students pass from one grade level to another grade level without acquiring and developing the expected ICT knowledge and skills.

ICT contents are nothing without practical applications in ICT laboratory sessions. In addition, every lesson of ICT should be supported by practice in computer laboratories to see better knowledge and skills acquired and developed by students. This implies that concerned bodies don't give due attention to the field. Therefore, supervision and support is expected from responsible bodies to construct additional ICT laboratories rooms at school to minimize the big class size in one laboratory session in order to bring better change in the education system. In addition, upgrade teachers' practical skills of ICT with short in service training on new and difficult contents.

5.2.5 The condition of ICT teaching learning process and ICT laboratory facility

The condition of ICT teaching learning process was seen with respect to teachers; subject matter knowledge, clear presentation, method used for teaching, ability of teachers to respond to students questions and encourage students to participate.

The observation data evidenced that almost all teachers are using lecturing as a method of teaching extensively. Teachers don't use any other method for motivating students. This is the problem of habit as most teachers' claim that their job is lecturing. This is a normal teaching/learning process with large number of students in a classroom at public schools. But with pedagogical science theory, it is important that every teacher should start his/her daily lesson by asking questions from the new and previous lessons in order to check whether the students understood the pervious lessons or not and then to adjust their instruction. But as observation indicates, the majority of the teachers started their teaching directly by introducing the daily lesson. However, the research shows that in most of the sample schools, teachers don't have pedagogical science knowledge. But they have interest to transfer knowledge to students as much as possible. Therefore, the result indicated that teachers are ready to help students at their maximum ability with theoretical knowledge in class and practical application at computer laboratories, if condition permit.

This implies that teachers lack some pedagogical knowledge and they use ICT lesson with simple lecturing without applying other methods of teaching technique. Therefore concerned bodies should develop ICT teachers' pedagogical science knowledge with short in-service training. In addition, since the computer laboratories have scarcity of resources, the responsible body should support and supervise the laboratories to fulfill with required resources for improving ICT teaching learning process and to equip students with ICT practical skills. Refer to Annex 5: ICT lesson and laboratories observation checklist.

5.2.6 Condition of secondary school current ICT curriculum

a) Opinion on the name of the subject ICT

Different countries in the world use ICT as a name for the subject in secondary schools. However, the study result shows that considerable number of participants from university instructors and secondary school teachers don't agree with this name. They justify that ICT has a broad meaning that contains all sorts of communication and communication devices such as computer and computer networks. In addition, it is an umbrella term and is not appropriate for secondary school ICT curriculum. But they suggest names like Computer and its application, Introduction to computer and Information technology.

Even though most participants agree with the name ICT as it is, few suggested to reconsider the contents and incorporating some communication and networking components in the future recommended ICT curriculum.

b) Perception on the major changes made on previous and current versions of ICT contents

The research finding revealed that the focus of the previous version was on how to use applications software only and **too generic** (it needs to cover topics related to computer hardware and software notions) but the current version is good that it is associated with many ICT topics and covers contents that assist students to acquire and develop the basic knowledge and skills required and more on **the fundamental concept of ICT**. But the time available to cover the whole contents is in question and needs proper scoping.

In the current ICT curriculum, contents of topics like image processing and multimedia systems are advanced related to the other topics included as the research clearly revealed. The recruitment of well qualified ICT experts and availability of the necessary hardware and software should be given due attention and consideration. The name computer security in the current ICT curriculum is better replaced by computer care and safety, because security without networking is difficult for students to understand. Control and learning with Logo portion needs software to give hint for students about programming concepts but teachers don't have proper training and the participants said that it is not necessary to include it as a

content. However, including basic troubleshooting and exploring the Internet was the best decision.

Therefore, the change was appreciated by most participants but they suggested that it needs proper scoping and consideration of school infrastructure situation of the country suitable to implement the contents.

c) Relevance and appropriateness of contents of ICT in current secondary school curriculum

Computer studies intend to furnish students with a broad knowledge of the nature of information processing and how Information and Communications Technology (ICT) is used today [4]. In today's world, education is said to be appropriate and relevant only if it considers the maturity (age) and grade level of students. We can also consider the situation of the country like availability of resources. In addition, we can say it is relevant and appropriate when it creates opportunity for employment, educational development, and leisure to students.

As the data analysis in this study revealed, the contents which are unanimously selected as relevant and appropriate for secondary schools are Introduction to ICT and application software (word processing, spreadsheet, publishing software and database application). Even though, one university respondent doesn't agree to teach database application like Ms Access *"because the content needs introductory concepts about databases for students to understand about primary key. So, we are obliged to teach database concepts before teaching MS Access and this leads to teach students beyond their grade and maturity (age) level"*.

Likewise, almost half of the participants suggested that basic troubleshooting is relevant to secondary schools. But, other contents like exploring the Internet, control and learning with Logo, information and computer security, and image processing and multimedia systems are considered irrelevant and not appropriate due to lack of resources, teachers trainings, and ICT infrastructure at school. As the finding showed most secondary school teachers indicated that exploring the Internet is irrelevant because of lack of Internet access at school but experience of other countries in ICT curriculum shows that exploring the Internet is very essential at secondary school.

In addition, one university instructor commented briefly *"to teach image processing and multimedia systems, students should have some algorithm concept to better understand the software."* So this needs special training even for teachers. Therefore, it should be omitted from the curriculum.

With other countries experience in the literature, ICT learning areas normally covered in high school should be computer hardware and software issues, word processing, modeling software, and spreadsheet, data and file management, computer care and safety, computer social and ethics issues, networking, information and communication system, programming concepts, and Internet and social media tools, and basic application of ICT in real life.

Therefore, the contents suggested by participants, the literature and the current ICT curriculum coincide with contents like introduction to ICT (hardware and system software), application software (word processing, spreadsheet, and database application), Information and computer security (computer care and safety), basic troubleshooting (Basic computer troubleshooting, assembly and upgrading) and exploring the Internet (Internet usage).

d) Difficult ICT contents teachers face to teach in the current curriculum

To transfer quality education to students, assessing content difficulty is very important. In ICT education, to transfer knowledge and skills to students, equipping schools with necessary resources and qualified teachers is very essential.

According to the data collected from university instructors and secondary school ICT teachers, some of the ICT contents are found to be difficult due to different reasons. The percentage of teachers claiming the respective contents difficulty is: Exploring the Internet (84%), basic troubleshooting (15%), image processing and multimedia systems (86%) and control and learning with Logo (46%).

When teachers were asked the reason why the respective contents were difficult, their responses revealed that contents are difficult due to lack of computers (92%), Internet access (73%) and with 44% and 53% for lack of training and software respectively.

The above result shows that the content called Exploring the Internet is very essential when ICT curriculum of other countries experience assessed. So, resources should be fulfilled to develop and implement ICT curriculum.

e) Students interest to learn ICT at secondary schools

To motivate students to learn ICT in secondary schools, first the schools should have qualified teachers and should be equipped with computer laboratories that help students to see the practicality of theoretical lessons studied in the class.

From the data collected and analyzed, 69% of teachers indicated that students are interested to learn ICT at secondary school. But from data collected using FGD, we came to understand that even if the students like to learn the subject, there are factors hindering them to follow with interest.

However, as a result of the research, some of the factors that are identified to affect students' interest to follow the subject are:-

- The ICT subject doesn't appear in national examination
- Private school students know more about computer at lower grade levels and most contents are repetitions for them. Therefore, they have no interest to attend.
- Computer laboratories are not equipped with sufficient computers and other resources.

This implies that students couldn't acquire ICT knowledge and develop skills without interest and motivation to the subject. Hence, the concerned bodies should give due consideration to the above factors affecting students interest to improve the quality of ICT education at school.

5.2.7 Development of textbook and availability of reference materials

Quality textbooks and teachers' guides and even reference materials are factors affecting quality of ICT education. The textbook and teachers guides become the most important and often the only source of content and pedagogic information for the teacher.

The study revealed that the ICT textbooks are full of explanations with long and irrelevant paragraphs, recommend for using software which are not available around schools and leave the use of software without enough step to apply and content notes.

98% of public schools teachers and students indicated that there are no relevant reference materials around school libraries that support students as references to assist them to consolidate and deepen their ICT knowledge and skills. But, the research revealed that students and teachers don't get reference materials at schools except the old basic application software like WordPerfect, MS Word, MS Excel, and MS Access. But in private schools teachers have access to the Internet and try to browse information and documents related to ICT.

Therefore, ICT textbooks should be written with skilled authors and edited with enough appropriate editors by considering students background knowledge of computer. In addition, qualified reviewers are very essential to evaluate the language, correctness of facts, consideration of maturity level of students and depth of contents goes in line with the syllabi and verify software recommended are available in the market.

Moreover, reference materials are very essential to consolidate and deepen teachers and students ICT knowledge and skills. Even though relevant ICT reference books are difficult to get in cities around schools, concerned body should purchase ICT reference books. In addition, create access to internet connection for teachers and students to browse information and documents about ICT using World Wide Web.

Chapter Six: Conclusion and Recommendation

6.1 Conclusion

The main focus of this research is to explore the status and recommend the future contents of ICT curriculum in Ethiopian secondary schools by assessing the need of students, teachers and educators.

Computer studies intend to furnish students with a broad knowledge of the nature of information processing and how ICT is used today. In Ethiopia, ICT education has been provided for secondary school students since 2000 G.C. The study revealed that ICT education is very poor with the following reasons. The current ICT curriculum didn't consider students background knowledge of computer and the feasibility point of view in our school situation and other countries experience of the world. Most schools don't have qualified ICT teachers; don't get training on new contents and lacks pedagogical science knowledge. Moreover, secondary schools suffer with scarcity of ICT resources. More than five students are sitting in one computer just to see but not to practice the ICT lessons. So, most students have no interest to learn ICT. In addition, the textbooks and teachers guides are of very poor quality and ICT reference materials are not available at schools except books of application software in old versions. These problems affect very much the ICT teaching/learning process and neither of the concerned bodies seems to make any interventions. Therefore, it is high time the concerned body fulfill appropriate resources if quality education is need at our schools.

As regards to ICT knowledge and skills that students should acquire and develop in secondary schools, the study suggested that the curriculum should include the following recommended contents as indicated in Table 6.1 [8, 27, 28].

Table 6.1: Comparison of ICT curriculum contents

Current ICT contents/ themes	Recommended contents/ themes
<ul style="list-style-type: none"> • Introduction to ICT • Application software • Information system • Information and computer security • Basic troubleshooting • Exploring the Internet • Control and learning with Logo • Image processing and multimedia systems 	<ul style="list-style-type: none"> • Introduction to ICT • Computer system • Computer and its applications • Computer care and safety • Basic computer troubleshooting (assembly and upgrading) • Information system and social media tools • Networks and communication • Exploring the Internet • Basic application of ICT in real life; • Problem solving and some basic programming concepts • Multimedia

The contents/ themes selected with the research finding and their sub-topics are:-

- **Introduction to ICT**
 - Information
 - Communication
- **Computer system**
 - Components of a computer system
 - Hardware parts and system software
 - Memory organization (main and auxiliary memory)
 - Peripheral devices (input and output)
 - Generation of computers
 - Types of computers
 - Windows operating system
- **Computer care and safety**
 - Computer laboratory rules and regulations
 - Management of computer and the environment
 - Ethics and integrity in computer use
 - Protection using password
 - Nature of computer viruses
- **Computer and its application**
 - Word processing
 - Spreadsheet
 - Database application
 - Presentation software
 - Publishing software
- **Basic computer troubleshooting (assembly and upgrading)**
 - Basic Troubleshooting
 - Maintenance of computer
 - How to fix illegal operation
 - How to fix a fatal exception error
 - Windows freezes or stops responding frequently, etc.
 - Hardware assembly
 - Computer upgrading (install and uninstall software)
- **Information system and social media tools**
 - Data, information and knowledge
 - Role of information system
 - Types of information system
 - Social media tools like Twitter, Facebook, Blog, and YouTube

- **Networks and communications**
 - Basic networking
 - Communication cycle, media and device
- **Exploring the Internet**
 - Services available in the Internet
 - The World Wide Web (WWW)
 - Browsing information
 - E-mail
 - Social and ethical issues (Internet safety)
- **Basic application of ICT in real life;**
 - E-commerce, e-learning, e-banking, e-library
- **Problem solving and some basic programming concepts**
 - Introduction to programming
 - System analysis
 - Basic web page design with notepad
 - Publishing to a web server
 - Basics of C++ and Java
- **Multimedia**
 - Basics of multimedia
 - Multimedia presentation
 - Application of multimedia

Therefore, the above contents are fundamental for ICT curriculum for secondary schools students and help to design standard curriculum of ICT implemented in different countries as we can see from the sample countries in the reviewed literature. These show the concerned bodies give attention and reconsider the curriculum very quickly.

Table 6.2 Suggested ICT curriculum main contents with grade levels

Grade 9	Grade 10	Grade 11	Grade 12
<ul style="list-style-type: none"> ● Introduction to ICT ● Computer system ● Computer and its application ● Exploring the internet 	<ul style="list-style-type: none"> ● Computer care and safety ● Computer and its application ● Exploring the Internet ● Basic computer troubleshooting 	<ul style="list-style-type: none"> ● Networks and communications ● Hardware assembly and upgrading ● Information system and social media tools ● Problem solving and some basic programming concepts 	<ul style="list-style-type: none"> ● Basic application of ICT in real life ● Computer and information ethics ● Web page design ● Multimedia

6.2 Recommendations

Technology is increasing in importance in business and all other areas of people's lives to the extent that technological literacy will become a functional requirement for people's work, social, and personal lives. The creative use of ICT in education has the capacity to increase the quality of young people's schooling by enhancing teaching and learning.

The study focuses on the status of ICT education curriculum in implementation for the past fifteen years. Most of the research findings need consideration and supervision by the concerned government sector and non-government bodies. Therefore based on the findings of the study, the following recommendations are given as possible ways out to improve the curriculum and the teaching learning process.

1. The availability of trained qualified ICT teachers at secondary schools as indicated on the research is low especially in the regions according to the annual educational abstract of 2004/05 E.C. Some schools even don't have ICT teachers. Those ICT teachers don't have pedagogical science knowledge. This needs serious consideration with the responsible government sector to recruit qualified teachers from the market and in addition should give in-service training on pedagogy and new contents for non-qualified teachers.
2. The need for a standard curriculum, qualified teachers, and resources in place were the high demands of the secondary school ICT laboratories. Nevertheless, the study indicated most secondary schools are not equipped with the required ICT resources like hardware, software and Internet connection. Even the existing resources do not function well. Therefore, responsible bodies should be involved to fulfill schools ICT laboratories with required resources that help students to gain and develop practical skills of ICT.
3. Even though naming of the subject ICT was acceptable by 80% of the participants, few have indicated that the ICT contents lacks communication part. Therefore, the future ICT curriculum should hold some basic knowledge of networking and communication media and devices.
4. Quality teaching learning materials (textbooks and teachers guides) and availability of reference material have a great role to give quality education. Also they broaden students' learning experiences and to meet different learning needs. However, ICT textbooks are not developed in proper way and ICT reference materials are not available at schools. Therefore, concerned bodies should involve and support to develop quality textbooks and teachers guides. In addition, support schools with reference materials by donation as well as build infrastructures of Internet to students and teachers to browse any information related to ICT to broaden their knowledge.
5. The finding indicated that students have no interest to follow the ICT subject at secondary schools because of different reason. To keep students interest and motivation about ICT

subject, concerned bodies should fulfill the resources, revise the curriculum, and make the subject to appear at national examination.

6. The international experience of ICT education shows that students at secondary school should know fundamentals in computer and information science, providing with the basic knowledge and skills in exploring different fields of sciences, and preparing them for their future life and role in the knowledge based society. Ethiopia to implement the ICT education as a subject effectively, consideration should be given to the situation of the country such as the background of students like late acquaintance with computers, scarcity of ICT resources and internet infrastructure, insufficient preparation of teachers in the necessary knowledge and skills, and so on. When we see the ICT curriculum of developed countries like England and America, students start using computers at early grade at the level of Kindergarten and have these capacities to follow any ICT contents at secondary education level without any difficulty. Therefore, to keep ICT curriculum standard with respect to experience of other countries in the world, the study recommends the main contents/ themes listed in the conclusion for Ethiopian Secondary school ICT education.

6.3 Future Work

This research is focused on exploring the status and suggests the way forward of ICT education in Ethiopian secondary schools. Due to time and financial constraints, the research has been done on a sample of ten urban secondary schools in Addis Ababa. The three areas covered in this study are:-

- ✓ Appropriateness and relevance of the current ICT curriculum contents to secondary schools in relation to other countries in the world,
- ✓ Availability of the necessary ICT resources and internet connection at schools ICT laboratories, and
- ✓ Availability of qualified ICT teacher, their readiness with pedagogical science and adequate in-service training on the new ICT contents.

In fact, the study clearly revealed that the condition of ICT education in our secondary schools is very poor and requires serious attention and supervision to solve the problems by concerned body.

We sincerely recommend that the following can be done in the future in order to enhance ICT education in our secondary schools.

- The status of ICT education in Ethiopian secondary schools can be studied in a wider and deeper scope, taking into consideration sample urban and rural schools from all over the regions of the country.

- Different literatures point out that the impact study carried out at the end of ICT education in secondary schools. It is very important to assess how far students' ICT knowledge and skills contribute to the society they live in and also to prepare them for further higher education. In light of this, more profound study can be made on impact of our secondary school ICT education as future work, in order to determine how far the ICT knowledge and skills students developed in secondary schools is helpful for the society at world of work and also to prepare them for further higher education learning.
- As far as the use of ICT in teaching/learning is concerned many countries have revised their curriculum to ensure that ICT becomes integral part of their education system. Some countries like ours offer ICT as a separate subject; others use ICT as a tool to teach other subjects integrated with the respective subjects. We recommend that a study be conducted in this respect in the future, to determine as how ICT education should be given to our primary and secondary schools by integration or as a subject depending on our concrete situation and other countries experience in the world.

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Annexes

Annex 1. University instructors' questionnaire

Dear Instructor,

The purpose of this questionnaire is to collect information on the new secondary school ICT education in order to be able to suggest the way forward for future ICT education in Ethiopian secondary school and bring improvement on the curriculum of the subject, based on the analysis of the data thus collected. Therefore, we kindly request your usual cooperation in filling the questionnaire and making appropriate suggestions, so as to bring a qualitative change in the nation's education. The information collected here would be kept confidential. Please use the sign "√" against your choices. And also write the necessary information in the space provided when required.

Thank you in advance.

University/Campus: _____ **Department** _____

Course : _____	Field of specialization: _____
University type:	Level you teach:
Private <input type="checkbox"/> Gov. <input type="checkbox"/>	1st year <input type="checkbox"/> 2nd year <input type="checkbox"/> 3rd year <input type="checkbox"/> 4th year <input type="checkbox"/>
	MSc. <input type="checkbox"/> PHD <input type="checkbox"/>

Section I: Personal detail

1.1 Gender: Male Female

1.2 Qualification: BSC MSC PhD Others **Experience:**

a) Total years of experience as an Instructor _____

b) Course(s) you teach at present

1. _____

2. _____

3. _____

c) Total number of years you have taught this/these/ course(s) _____

Section II :ICT Curriculum

2.1. Do you know the curriculum of ICT at secondary school? Yes No

2.2. If your response to question #2.1 is “Yes” or “No”, try to evaluate the relevance and appropriateness of the contents as shown in 3rd version of question # 2.3?

a) Very good b) Good c) Medium d) Poor e) Very poor

2.3. How do you evaluate the drawbacks and relevance of the change between the previous and current version of IT / ICT curriculum contents? To recall main contents:-

1st version (2000):- application software (Ms Word, Ms Excel, Ms Access)

2nd version (2004):- application software with publisher and some networking

3rd version (current):- Introduction to ICT, Info & computer security, application software, basic troubleshooting, control & learning logo, exploring Internet and Image processing and multimedia system

2.4. What is your general opinion on the major change made from the previous version of IT curriculum?

2.5. Do you agree with the current name given to the subject **ICT** at secondary school?

Yes No

2.6. If your response is “No” for question 2.5 above, what name do you suggest and please add some justification?

2.7. Which knowledge and skill of information and communication technology should students gain at secondary school in your opinion?

2.8. In the current ICT syllabi of Ethiopian secondary school, which contents are relevant and appropriate to future ICT Education (select as much as it is appropriate)

- a) Introduction to ICT b) Application software
c) Information and computer security d) Exploring Internet
e) Basic troubleshooting f) Control and learning with logo
g) Image Processing and multimedia Systems

h) Other contents you suggest; _____

2.9. Which contents are difficult to teach in our school situation and beyond ICT teachers’ knowledge and skill in the current syllabi?

2.10. Some countries' experience from literature indicates that, they suggest to teach programming and database in secondary school. What do you say on these contents according to our school situation and training of teachers?

2.9 What do you suggest for further improvement of the curriculum of ICT in secondary school?

2.10 Other Observations/Comments/suggestions

Section III. Training/Orientation

3.1 Have you ever observed the undergraduate course given at University level enable to teach the ICT contents in high school without any additional training?

a) Yes b) No

3.2 If you feel undergraduates need training or orientation (inservice training), in which main contents teachers need to fill their skill gap to teach effectively the ICT subject?

3.3 Other Observations/Comments/suggestions on teachers training and orientation

Annex 2. Secondary school ICT Teachers' questionnaire

Dear Teacher,

The purpose of this questionnaire is to collect information on the new secondary school ICT education in order to be able to suggest the way forward for future ICT education in Ethiopian secondary school and bring improvement on the curriculum of the subject, based on the analysis of the data thus collected. Therefore, we kindly request your usual cooperation in filling the questionnaire and making appropriate suggestions, so as to bring a qualitative change in the nation's education. The information collected here would be kept confidential. Please use the sign "√" against your choices. And also write the necessary information in the space provided when required.

Thank you in advance.

School Name: _____ **Sub-city** _____

Department: _____	Subject you teach: _____
School Type:	Grade(s) you teach:
Private <input type="checkbox"/> Gov. <input type="checkbox"/>	a) 9 <input type="checkbox"/> 10 <input type="checkbox"/>
Other <input type="checkbox"/>	b) 11 <input type="checkbox"/> 12 <input type="checkbox"/>

Section I: Personal detail

1.1 Gender: Male Female

1.2 Qualification: Diploma BSC MSC Others

1.3 Subject Major _____

Subject Minor, if any _____

1.4 Experience:

d) Total years of experience as a teacher _____

e) Subject(s) you teach at present

1. _____

2. _____

3. _____

f) Total number of years you have taught ICT _____

Section II: ICT Curriculum

2.1. Do you have ICT syllabus and textbook of secondary school? Yes No

2.2. If your response to question #2.1 is “Yes”, how do you evaluate the relevance and appropriateness of the contents?

a) Very good b) Good c) Medium d) Poor e) Very poor

2.3. How do you evaluate the drawbacks and relevance of the change between the previous and current version of IT / ICT curriculum contents? To recall main contents:-

1st version (2000):- application software (Ms Word, Ms Excel, Ms Access)

2nd version (2004):- application software with publisher and networking

3rd version (current):- Introduction to ICT, Info & computer security, application software, basic troubleshooting, control & learning logo, exploring Internet and Image processing and multimedia system

2.4. What is your general opinion on the major change made from the previous version of IT curriculum?

2.5. Do you agree with the name given to the subject **ICT**? Yes No

2.6. If your response is “No” for question 2.5 above, what name do you suggest and please add some justification?

2.7. Do the students have interest to learn ICT as a subject? a) Yes b) No

2.8. If your response for question 2.7 above is No, what is the reason for that?

2.9. In the current ICT syllabi of Ethiopian secondary school, which contents are more relevant and appropriate? to future ICT Education

a) Introduction to ICT b) Application software

c) Information and computer security d) Exploring Internet

e) Basic troubleshooting f) Control and learning with logo

g) Image Processing and multimedia Systems

h) Other contents you suggest; _____

2.10. Which main contents and sub topics of ICT are difficult to teach in secondary school?

2.11. If you list difficult contents and sub topics from the current syllabus, please indicate your reasons as to why these contents are difficult to teach?

a) Lack of training b) lack of computers

c) Lack of software d) lack of internet access

e) Others reasons: _____

2.12. Is there any problem with the development of ICT Textbook and teachers guide

Yes No

2.13. If yes, in your view, what are the major problems related to development of the new ICT textbooks and teachers' guides?

2.13. If you observe problems on the development of the textbook and teachers' guide, which Topics and main contents have problem?

2.14. Do you get reference material around your school to refer difficult contents?

Yes, I get many yes, I get some No, I don't get

2.15 If you say “yes I get some” reference material” in question 2.14, in which ICT contents area mostly you obtain?

2.16 What do you suggest for further improvement of the curriculum of ICT secondary school?

2.17 Other Observations/Comments/suggestions

Section III. Training/Orientation

3.1 Have you ever taken any skill training or orientation on how to use the new Textbook and Teacher Guide?

a) Yes b) No

3.2 If you have taken any training or orientation, how helpful the training/orientation was/is in enabling you teach the ICT subject effectively?

a) Very helpful b) Helpful c) Only some help d) Not helpful at all

3.3 If you did not take any training/orientation, please specify the type of training/orientation you need to fill your skill gap to teach the new ICT subject effectively?

Annex 3. Secondary school (preparatory) students FGD

Addis Ababa University Department of computer Science

Focus Group Discussion Questions (FGDQ) for students

(Secondary school especially for preparatory students)

1. How do you evaluate ICT class and contents in your secondary school?
2. Do you have interest to learn the subject ICT in your secondary school?
3. Which contents are difficult to learn ICT in secondary school?
4. Do you get enough computers, software, kits for troubleshooting and reference material to learn ICT?
5. How do you evaluate the teachers' knowledge and skill to teach ICT in secondary and preparatory level separately?
6. If you say teachers lack knowledge and skill, in which contents they face difficulty to teach in ICT subject?
7. What do you think are the major strengths of the subject?
8. Do you think the new textbooks satisfy your interest? In your view, what are the major problems related to development of the new textbooks?
9. What solution do you suggest to resolve/fix some of the problems in ICT teaching learning process?
10. Is there anything else that you will tell us about the future curriculum of ICT?

Annex 4. 1st year computer/information science students FGD

Addis Ababa University Department of computer Science

Focus Group Discussion Questions (FGDQ) for students

(Information system and computer science students)

1. What do you recall about ICT class and contents in your secondary school?
2. Did you have interest to learn the subject at your secondary school?
3. Which contents were difficult to learn in secondary school?
4. Did you get enough computers, software, kits for troubleshooting and reference material and textbook to learn ICT?
5. How do you evaluate the teachers' knowledge and skills to teach ICT in secondary and preparatory level separately?
6. If you say teachers lack knowledge and skills, in which contents they face difficulty to teach ICT subject?
7. What do you think are the major weakness and strengths of the subject?
8. Do you think the new textbooks satisfy your interest? In your view, what are the major problems related to development of the new textbooks?
9. Did you find your high school ICT education beneficial for your field of study in the university?
10. What solution do you suggest to resolve/fix some of the problems in ICT teaching learning process?
11. Is there anything else that you will tell us about the future curriculum of ICT?

Annex 5. ICT lesson and laboratories observation check list

**Addis Ababa University
Department of computer Science**

Class room observation checklist

School Name _____ year of Establishment _____

Sub-city _____ No. of ICT teachers _____ Grade observed _____

ICT Laboratory Vs. Student ratio _____ Title of the lesson _____

Objective of the lesson _____

N.B- 5- Excellent 4-Very Good 3-Good 2 –Not bad 1-weak

S. No	Criteria	Points				
		1	2	3	4	5
1	Teaching learning process					
1.1	Subject matter knowledge					
1.2	Lesson understanding & Clear presentation to students					
1.3	Different methods & strategies used to teach					
1.4	Ability to respond to student questions/ diverse needs					
1.5	Encourage students to understand the lesson					
2	Practical application to theoretical lesson					
2.1	Teacher knowledge and skill in practical work					
2.2	Clear instruction to practical work					
2.3	Teachers help students to practical application					
3	Computers, software and Internet connection					
3.1	Sufficient computers in laboratory					
3.2	Computers loaded with appropriate software to teach					
3.3	Good Internet connection to use the WWW					
3.4	Kits for teaching maintenance & troubleshooting					

Weak points

Strong points

Comment

Declaration

I, the undersigned, declare that this research is my original work and has not been presented for degree in any other university, and that all sources of materials used for the research have been acknowledged.

Declared by:

Name: **Abebe Basazinew Bekele**

Signature: _____

Date: _____

Confirmed by adviser:

Name: **Dr. Mulugeta Libsie**

Signature: _____

Date: _____

Place and date of submission: Addis Ababa University, February, 2014.