PERCEIVED IMPACT OF INFORMATION AND COMMUNICATION TECHNOLOGIES ON LEARNING AND TEACHING

By

R.T.A.L Panangalage

The Dissertation was submitted to the Department of Computer Science and Engineering of the University of Moratuwa in partial fulfillment of the requirement for the Degree of Masters of Business Administration.

CD-Rom Included

Department of Computer Science and Engineering

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ABSTRACT

The use of ICT in education sector is an important topic in most developing countries today as it is playing a central role in socio–economic development. There are many ICT initiatives in Sri Lankan education system over the past decade. This is the best time to evaluate those efforts for their effectiveness.

Objectives of this research is to assess the impact of ICT on learning and teaching in secondary schools in Sri Lanka, to assess the current ICT usage in schools, to identify the drivers and barriers for achieving a greater impact of ICT on learning and teaching and to derive a set of recommendations, that would help future policy making.

The chosen methodology is to ask questions from the key stakeholders of the school about how they perceive the impact of ICT on learning and teaching. Data collection in the study is based on three questionnaires. Respondents are the head of the school, teachers and students in grade 10 to12 classes. The study covered 80 schools among the Secondary Education Modernization Project funded schools.

The research study found that there is no direct relationship between the computer usage of students and their perceived impact of ICT on learning. Both students and teachers attitude toward use of ICT for learning and teaching purposes are statistically significant and positively related to their perceived impact of ICT on learning and teaching. However, the relationship between ICT skills and their perceived impact of ICT on learning and teaching found only for students but not for teachers and principals. The government intervention and training are not related to both teachers and principal's perceived impact of ICT on learning and teaching. Furthermore, research found that mere presence of ICT infrastructure in schools has not contributed students' learning.

Key Words
ICT, Impact on Learning, Impact on Teaching

ACKNOWLEDGMENT

DECLARATION

"I certify that this thesis does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any university to the best of my knowledge and belief it does not contain any material previously published, written or orally communicated by another person or myself except where due reference is made in the text. I also hereby give consent for my dissertation, if accepted, to be made available for photocopying and for interlibrary loans, and for the title and summary to be made available to outside organizations"

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Supervisor   13/02/2008

Dr Ajith Pasqual

iv

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

ADB	-	Asian Development Bank
CAL	-	Computer aided learning
CDROM.	-	Compact Disk Read Only Memory
CINTEC	-	Computer and Information Technology Council
CLC	-	Computer learning centers
CRC	-	Computer Resource Centers
GIT	-	General information technology
ICT	-	Information and communication technologies
ICTPD	-	Professionals Development in Information and Communication Technology)
ITMF	-	ICT and Media in the Danish Folkeskole
MMU	-	Multimedia units
PISA	-	Programme for International Student Assessment
SEMP	-	Secondary Education Modernization Project
SPSS	-	Statistical Package for Social Sciences
WWW		World Wide Web

1. INTRODUCTION

There is an emerging and an irreversible trend in Asia and many countries across the globe to use Information and Communication Technologies (ICT) in education and this is widespread and continuously growing. The United Nation's Millennium Development Goals (MDGs) and national development plan of most countries are targeting for improving the education sector [1]. The former UN Secretary-General has emphasized in a UN forum that ICT must be used to promote development in education to achieve MDG [2]. Many believe that the natural synergies between the education and ICT potentially move these countries towards a knowledge society.

ICT integration in education has many broader objectives varying from creating a good talented work force for the knowledge society, to promote educational reforms and to modernize learning and teaching. The use of ICT in schools can be considered in two ways: one focuses on studying the ICT itself (technological education) and the other focuses on getting ICT support for learning and teaching (educational technology). This review is mainly focused on educational technology [3].

Schools in some developing countries have already embedded ICT into the curriculum, and have demonstrated high levels of appropriate ICT usage to support teaching and learning. However, schools in certain other countries including Sri Lanka are still in the early stages of ICT adoption.

1.1 Background for Research

The following section discusses about the background for the research. It briefly discusses about the nature of the education system of the country, ICT history of the country, ICT policies of the country, ICT policies in education, current ICT status of the country and finally the challenges identified when introducing ICT in schools.

Education system in Sri Lanka

Free education was established in Sri Lanka in 1945. Free education and many other government and non- government initiatives contributed to high literacy rate of 90.7% in the country [4]. The school system consists of government schools, private schools and Pirivenas (Buddhist monastic institutions). According to the government statistics [5], there are 3,991,793 students in the general education system of which, 3,836,550 are in government schools, 99,964 are in private schools and 55,279 are in Pirivenas.

There are four categories of government schools. They are 1AB schools (are those with A/L Science stream), 1C schools (are those with Arts / Commerce streams but without Science stream), Type 2 schools (are those with the secondary cycle (up to GCE O/L)) and Type 3 schools (are primary schools up to grade 5). The general education system consists of three stages as, Primary Level (Grades 1-5), Secondary Level (Grades 6-11) and Collegiate Level (Grades 12-13). The Secondary level is again sub divided in to two levels. i.e. Junior Secondary (Grades 6-9) and Senior Secondary (Grades 10-11) [6].

In the senior secondary level, Information & Communication Technology has been introduced as a technical subject from year 2006. For the Collegiate level, there are 3 streams, Science, Commerce or Arts. Recently, the Ministry of Education has added a fourth stream called the Technological Stream and introduced General Information and Communication Technology as an awareness subject for GCE A/L Grade 12 [7].

ICT history of Sri Lanka

Computers were first introduced in early 1960's for very large government sector institutes. During the period of 1970-1977 there was not much development in the usage of computers in private sector due to strict import restrictions. In 1977 with the introduction of open economy, there was a slight improvement in the usage of computers in the private sector. In early 80's

CINTEC (Computer Council) was established to advise the government regarding the computer usage. In 1983 there were some government initiatives to introduce computers to schools, which was not very successful. [8]

The personnel computers were introduced in late 1980. Restructuring of the telecommunication sector was started in 1980 with separation of the Department of Postal and Telecommunications. A massive development occurred in telecommunication industry during this period. Over the last decade the tele-dencity has increased form 0.7 to 8 phones per every 1000 person. Then first satellite phone service was introduced in early 2002 [9].

The establishment of cabinet ministry for IT happens in year 2000 and Telecom Ministry was merged into the IT Ministry. This was a major milestone in the ICT history. IT in School Education was approved in late 2001. National level steering committee was established in 2002 to formulate a National ICT Policy. "e-Sri Lanka", the ICT development road map of Sri Lanka was officially launched in November 2002 [8].

United Nations Information Technology Service (UNITeS), together with Sri Lankan government has established the ICT training centre of the Malamulla Bauddha Balamandalaya (MBBM) in Panadura. The emphasis of this program is to develop e-education and on-line learning [10].

Secondary Education Modernization Project (SEMP) was initiated by the World Bank and the Asian Development Bank (ADB). This is one of the most important projects initiated in recent history of Sri Lanka. The aim of the project is to introduce computers to schools and to teach computer skills to high school students. The main focus is on developing computer literacy to narrow the digital divide [11]

ICT Policies of the country

The National Computer Policy (COMPOL) was formulated in 1983 for the first time in Sri Lanka with the aim of developing ICT in the country.

COMPOL was produced by the Natural Resources, Energy and Science Authority of Sri Lanka (NARESA) on the order of president. After this there were many draft ICT policy documents produced, but they were not successfully implemented due to various reasons [12]. Major issues facing the use and / or growth of ICT in the country are political situation, macro economic situation, education policy and telecommunication infrastructure [13].

The "e-Sri Lanka", project launched in November 2002 was tasked with development an ICT Roadmap for Sri Lanka [13].

ICT in Education Policy

The vision of the ICT in Education Policy in the Ministry of Education is "Digital Bridge through Education" and the mission is "Preparing knowledge based society through developing knowledge and skills in Information and Communication Technology" [12].

The Ministry of Education realizes that the ICT has a huge responsibility and a role in meeting the skill requirements of the information technology industry as well as addressing the issue of digital divide widening in Sri Lanka. Further, results of the National IT workforce survey 2007 done by the Sri Lanka ICT Association (SLICTA) revealed that skills of the considerable amount of workers' in the country do not match with the market demand. Therefore ICT policy in Education must address this issue by considering the global trends [14]. Therefore the Ministry of Education has paid special attention to introduce an ICT policy in education. The National Policy on IT in School Education (NAPITSE) was introduced to better equip the younger generation of Sri Lanka with the state of the art information technology and to improve the IT literacy of the education sector [15].

Current Status of ICT

This section presents the current status of ICT in the country and data are taken from the paper presented to the e-Global Leaders Conference 2007 [7]. Computers were first introduced in the Sri Lankan education system in 1983. A Few schools provided with basic home type computers. However, this was not very successful. In 1994 Computer Resource Centers (CRCs) were set up with the objective of providing computer literacy to students who sit the GCE O/L and GCE A/L examinations and who were awaiting results.

In 1999, the government purchased 1790 computers and distributed among 615 schools. From 2001-2004, the World Bank funded General Education Project II (GEP II) establishing 400 ICT Centers in schools. Teacher Education and Teacher Deployment (TETD) project provided ICT labs to all National Collages of Education (NCEOs). Under this project, to train the teachers in provincial level, another eight provincial ICT centers were established.

The Asian Development Bank funded Secondary Education Modernization Project (SEMP) established 1006 Computer Learning Centers (CLC) by 2006 and it has planned to establish 351 more centers under the SEMP II project in the year 2007/8.

In addition to these government initiatives, NGOs' like Sarwodaya is conducting "Telecenters" and "Nanasala" (introduced under e-Sri Lanka project) to provide community access to ICT.

Table 1-1 shows the details of the existing ICT labs in the country by end of year 2007.

Table 1-1 : Details of existing ICT labs in the system by 2007

Time	Name of the centers	Number of centers	Funded Agency
1994 - 2007	Computer Resource Centers	100	CF. ADB(SEMP)
1999	School Computer Centers	615	CF (Consolidated Fund)
2001 - 2004	Information Communication Technology Centers	400	World Bank (GEP11)
2002 – 2004	**Provincial ICT Centers**	09	World Bank (TETD Project)
	Donated computers	50 (approx.)	Donations
2001 – 2007	Computer learning Centers	1357	ADB (SEMP)
Project period	Novodya lab	331	CF
2006	LEAD project	41	CF
2002-2007	Model school computer labs	200*	CF/IBM
2006-2007	SPECE Project	100*	India/CF
2007 (Ongoing)	ICT Units in National Schools	09	CF
		06	ESDG (Education Sector Development Grant)
	School ICT units	42	CF
Total		**3260**	

*Small computer units for primary sections

<div align="center">Source: ICT in Education Policies in Sri Lanka: Challenges and Opportunities [7]</div>

The Ministry of education is having a strong focus on developing ICT human capital as well. The Ministry has taken initiatives to provide training for teachers as well as principals and officers. About 60,000 teachers and officers have been gone through different levels of ICT training programs. The details of the teacher training programs are shown in the Table 1-2.

Table 1-2 : Details of trained teachers and officers for ICT education

Name of the Project	Basic training	ICDL training	Short term training	Diploma	Post Graduate Diploma	Masters	Foreign
World Bank	6400	-	1000	200	200	20	80
ADB/SEMP	34129	12500	1675	76	-	-	22
SPACE Project	80	-	-				
) Nawalova (Microsoft)	1764	-	-				
LEAD project	80	-	-				
O/L ICT	4800	-	-				

A/L GIT	1300	-	-				
Total	48553	12500	2675	276	200	20	102

Table 1-3 summarizes the present ICT infrastructure and ICT human capital availability of the Sri Lankan education system.

Table 1-3 : Details of trained teachers and officers for ICT education

Category	Number
Number of students in the system	3,900,000
Number of computers in the system	30,000
Computer student ratio	1:130
Number of Network connections	890
Number of teachers with PC ownership	2500
Number of teachers in the system	205,000
Number of teachers already trained for ICT	60000
Number of computer clubs	500

In addition to the provision of ICT infrastructure and ICT professional training of teachers, the Ministry has taken initiatives to develop and implement curricular for ICT education. Now ICT is offered as an optional subject for both G.C.E A/L and G.C.E O/L and it has been introduced as a teaching and learning tool.

Several supporting programs were initiated in order to improve the learning and teaching process such as; dedicated internet connections were supplied to the schools via school net, Innovative teachers' competition was introduced with collaboration of Microsoft to identified ICT competent teachers in the schools and conducted several ICT campaigns to boost students' interest for the ICT.

Challenges identified when introducing ICT in schools.

The main issue is the lack of ICT human capital in the country. Even though teachers are trained through several ICT professional programs they were not properly utilized due to many reasons. Main reason is that there is no separate allocated teacher cadre to ICT subject in the schools. The teachers who were

7

sent for the ICT training were not completely responsibility for teaching ICT or could not take part in the ICT implementation process of the schools, because they are have other subjects to look at too [7].

English is the dominant language in the World Wide Web (WWW) and most of other ICT material. Even though English is taught as a second language from grade 3 to grade 11, majority of students are still not conversant. This makes both teachers and students less comfortable to use ICT in their learning and teaching [7], [16].

1.2 Research Problem

This study is carried out in the SEMP funded schools to address the question of what has been the impact of ICT investment and ICT integration in these schools in the two main areas learning and teaching.

1.3 Research Objectives

To carry out a survey to assess the current ICT usage in schools, to identify the drivers and barriers for effective use of ICT in schools and to derive a set of recommendations, that would help future policy making.

1.4 Research Design

The first step would be to analyze schools for their usage of ICT, success factors and barriers of ICT usage. A literature survey was carried out to find out how ICT is used in schools. Further, the key factors which influence the usage of ICT and how other countries have successfully adopted ICTs and the barriers they have faced during adoption will be identified during the literature survey.

Next a theoretical framework will be formulated using the exploratory studies carried out via literature survey and interviews held with consultants in the education sector. A suitable sample will be selected from the schools which are funded by ADB-SEMP project.

Postal questionnaires will be used as the research instrument to collect data. Researcher plans to enclose all the questionnaires with a covering letter from the Provincial Education Director of each province, to overcome the anticipated low response rate of the postal questionnaires

The analysis will be done using a suitable statistical method to identify the impact of ICT on students learning and teaching process with regard to several aspects discussed in chapter 3. Further, drivers and barriers for successful ICT integration will be identified from the analysis. Recommendations will be made depending on the results of the analysis.

Next chapter discusses about the findings of the literature survey and chapter 3 out line the research methodology. In this chapter more emphasis is given for the formulation of the theoretical frame work of the research, criteria for sample selection and methods of data collection. Chapter 4 presents the findings of the research including results of the hypothesis. Chapter 5 highlights the key findings of the research and final chapter presents the recommendations and conclusion of the research.

2. LITERATURE REVIEW

The reported ICT usage of students and their attainment levels have been investigated in many research studies. The uses of ICT for various purposes have been taken into consideration in measuring the reported ICT usage. The ways and means of measuring the level of attainment of the student is not consistent across the past literature. Some studies have used national test results as the measurement; whereas other studies have used the observed improvement in students learning outcome. Also there are others who have measured the perceived impact on students learning instead of measuring it. They have considered different stakeholders view of the impact of technology on student's achievement.

2.1 Use of ICT

The use of ICT for learning purposes is reported in many ways to aid learning process. Students at all levels have been involved in writing using ICT mediums which provide grammar and spelling checks. Interactive white boards provide students more opportunities to improve their writing skills. Multimedia accessories like headsets provide a greater opportunity for students who are poor in their listening skills [17].

Presentation technologies lead to greater interaction between teachers and students and they influence students more due to their visual nature, clarity, pace and interactive involvement. Presentation technologies improve students' interpersonal skills to a greater extent as well [18].

Students were greatly involved in project work and the output they produced was enhanced by the use of ICT. Also technology enabled students to present their group work to the whole class, which encouraged the whole class to participate in discussions and give constructive feedback [18].

Use of network technologies enable students to get maximum benefit from the World Wide Web (WWW) and make it possible for learners to access wide

variety of free resources in addition to class room reference texts. Further, Web creates a user friendly environment for the users. In case of distance learning web is more useful [16]. Research material on the Internet is one of the greatest benefits students can obtain by the use of ICT. Access to learning management systems through school intranet (most of the time this is referred to as 'SchoolNet') resolve the issues of finding learning contents from expensive study packs for student assignments. Internet protocols and local school level strategies for accessing Internet safeguard students from accessing inappropriate and unnecessary contents [19].

The results of the Programme for International Student Assessment (PISA) studies claimed that students use computers for wide range of activities such as, educational research using internet and accessing learning materials, word processing, computer programming and use of educational software. However the study also reported that students do not use educational software very often. Once the students are confident with wide range of ICT tools, it is just a matter of making of it for learning as appropriate [17].Even though computers can be used as a new learning tool it can also badly affect the students learning due to computer games. If students addict to computer games they may loose time which will otherwise be used for learning purposes [16].

2.2 Skill Level

When it comes to the ICT skill level of students, the confidence in using and managing technology (i.e. starting and shutting down computer, creating and managing computer files and folders and creating, editing and saving documents), use of internet technologies (i.e. such as internet browsing, web searching), high level tasks (i.e. computer programming and database programming) have been identified as most common ICT capabilities required for effective use of ICT in learning. Generally students demonstrate more confidence in using and managing technology than internet technologies. Students who are confident in using and managing technology perform well above the ones who are not so confident [17].

Reports of positive relationship between computer proficiency and students achievement can be seen in many studies [18].

2.3 Experience

There is a great tendency towards investing in acquiring computers among most of the parents. Parents pave the path to their children by providing them the opportunity to continue their studies using computers, thus preparing them to enter into the information and digital age fully equipped. Government and local school authorities are taking several initiatives to ensure that all students get universal access to computers at schools. Some students have started using computers very recently, while some other students have been using computer for quite a long time. Most of the time students who have computers at home have been using them for many years [20].

The PISA study shows that the students who used computers for more than five years performed well at level three in mathematics as they were very familiar with the technology and they are fairly knowledgeable on how they should use and manage technology. Students who started using computers recently did not perform at the same level as with experienced students. Students with less experience struggle with technology which hinders their concentration on the subject. A positive relationship between the number of years students have been using computers and their performance was observed. Students with little experience scored poorly than those with several years of experience [17].

2.4 Student's Attitudes

ICT can positively impact not only on student's learning outcomes but also the motivation and acquisition of new skills. A study carried out in Physics classes in Kenya found that students who got computer based instructions had more positive attitudes towards instructions than those received instructions without computers. It was found that ICT was perceived to increase students'

confidence and motivation to learn by making school work more enjoyable and interesting [21].

2.5 Impact on Learning

Most people believe that there is a direct connection between the use of ICT and learning outcomes. It is not easy to conclude that improved pupil attainment is purely a result of using ICT and many educational researches have given evidence against that [19]. They agree that there will never be a direct link between the use of ICT and learning outcomes because the ICT is only one element of the learning environment. Therefore it is not possible to isolate the impact of ICT from all other elements of leaning environment that contributed to the pupil's achievement. However, a positive relationship between ICT use and improvement in subject-related learning has been reported in many subject areas [22].

Test Bed project, one of the largest project carried out in UK investigated how the embedded use of ICT in learning environment can improve learner outcome. In Test Bed schools national test results were improved beyond expectations after embedding technology into the learning environment. This has proved that improvement of English subject at key stage 2 has outperformed the comparator school with very high level of significance after technology was embedded into schools. However the impact of student's attainment was significant in primary schools than secondary schools. Primary school students were involved in more integrated project work across the curriculum, involved more in writing though the medium of ICT and made use of presentation technologies to a greater extend. [23]

There are certain circumstances where greater computer use adversely affects the performances of students resulting negative relationship between the use of ICT and students performances. This has taken place mainly due to spending a lot of time on computers doing unnecessary things and/or concentrating more on how to handle the technology than actual subject matters. [18]

13

The recent study in UK 'New Technology in schools: is there a pay off?' finds evidence for positive relationship between an increase in ICT investment and a rise in educational performance in primary schools, specifically, in the teaching of English and Science. Interestingly, they did not find evidence for positive impact for teaching of Mathematics [24].

The Norway's largest and most comprehensive study supporting the educational use of ICT in schools is the Pilot project (Project Innovation in learning, Organization, and Technology). 52% of students concluded that ICT increased their performance in school subjects and it was confirmed by the 83% of the teachers. The project shows that both reading and writing skill levels were higher of those who use computers. The project observation proved that students use ICT more frequently and more towards educational resources than entertainment [25].

ImpaCT2 research study was conducted by BECTA (British Educational Communication and Technology Agency) and it is considered as the one of the most comprehensive investigations conducted in UK in the area of impact of ICT on educational achievement. This analyzed the relationship between student's performance in national test and their reported usage of ICT at three age levels. At key stage 2, a positive association was found between the ICT use and English and Science. However, only the association between ICT use and English was statistically significant. At key stage 3, there was a statistically significant positive association between the use of ICT for the Science subject and the attainment level at national test. At key stage 4, positive associations were found for GCSE Science, GCSE Design and Technology, GCSE Modern Foreign Languages and GCSE Geography [18].

ImpaCT2 Studies found evidence of a positive impact of ICT use on certain subjects and it was not a consistent relationship between average amount of ICT reported for any subject and it's effectiveness in raising standard at national examinations. However, the study (ImpaCT2 study) concluded that there is no direct relationship between the average amount of ICT use for any

14

subject at a given key stage and the effectiveness in raising standards. What all maters is the type of use of ICT in schools not the amount of use [18].

The use of ICT can support the learning of other skills, which are named as "21st Century Skills", that supports the economic development. These skills include technology literacy, information management, and communication, working in teams, entrepreneurialism, global awareness, civic engagement, and problem solving skills. Incorporation of these subjects in to the curriculum enables students to get the maximum benefit in using of ICT and they can be the key stakeholders in the economic development of the country. [26]

2.6 Teaching Process

During past couple of decades there has been a considerable amount of progress in integrating ICT into schools. Over the period, access to ICT has become more universal, when more and more education software are available and teachers and students have gained more confidence in using and managing technology [27].

2.7 Professional Training

Teacher education focuses mainly two areas. First area is technology education, which considers "learning-to-use" technology. Teachers first should acquire necessary skills and competency to use technology. Second area is educational technologies where use the technology to learn, referred to as "use-to-learn". This focuses on how ICT can be effectively used to enhance learning and teaching process [27].

Today most of the new teachers consider ICT as an integral part of their professional career. However, many traditional teachers who struggle with technology are apprehensive about using ICT to aid teaching and learning. The professional development programs can help them to move forward and they can give strong emphasis on use of ICT to aid teaching. Good professional

support ensures that teachers are confident in using technology and they gain enough capabilities to use them confidently in front of students [18].

During last few years' educators put effort on building and strengthening teacher's knowledge on technology skills. What still lacking is the skills and competencies required to integrate ICT into the total learning and teaching process [27].

Three stages in teacher's professional development in ICT that have been identified by the UNESCO's Asia and Pacific Regional Bureau for Education is as follows. [28]

Basic computer literacy

Basic computer literacy consist of use of and managing technology, computer operating systems and general awareness of application software which can be used in documentation and communication and basic calculation like MS office. This is not necessarily related to the teaching and learning process

The use of ICT hardware and software for teaching/learning activities

This category includes the same content as basic computer literacy but this is associated more to the teaching and learning process. Examples are use of presentation technology to deliver subject related contents, use of publishing software to create news forms and newsletters, use of video conference to present specialized subject matter which conducted at a distance from the schools, use of spreadsheets to analyze a data from a science experiment and develop relationship, use of email and internet chat to assign tasks to students and encourage students to participate in online problem solving tasks and online school based assessment systems.

Pedagogy-based ICT use

Last stage includes the more advance concepts like use of internet and use of communication technologies like email and web forums for collaborative projects and internet researches. Use of ICT in teaching specific subjects will also consider under this stage

Several case studies can be found from the Asia Pacific region for innovative use of ICT for teacher education.

Mongolia, one of the project countries, was asked to reduce the funding for education due to bad economic situation. utilized distance education and reached more teachers quickly and more frequently than traditional way at an affordable cost. Cheep ICT equipment like radio and audio cassettes were selected as more appropriate technologies to adapt to changes in technology and learning strategies. Mongolia demonstrated new ways of utilizing scarce resources even though distance learning is not new to the rest of the world. [29]

Professional development of teachers to incorporate ICT into teaching and learning should be an ongoing process. Teachers need to update their knowledge and skills on new technologies and changing curriculum. Professional development should commence with the teachers pre service and it should be aligned with in-service teacher education. The teacher educators (Who train teachers) should also get opportunities to update their knowledge and to make sure that they use technology effectively in their training sessions. Training programs must consider the individual learning styles of teachers when designing training programs. Some teachers are more confident in online work while some other teachers prefer face-to face discussions. Training programs must be designed in such a way that it addresses the individual training needs.

Most of the past literature evidence suggests that teachers gain positive attitude towards using technology through government intervention and training programs [25]. Teachers who took part in the Interactive White Board pilot project were extremely positive about the technology [22].

Specific government interventions like Interactive White Boards and Test bed project in UK seems to have more positive impact on enhancing teaching process than national wide training programs due to the fact that they were

implemented directly in schools, thus being able to follow up more closely over the period where the teachers were guided on the job . [20]

2.8 Teachers' Experience and Confidence

The ICT and Media in the Danish Folkeskole (ITMF) evaluations found that even though teachers have access to better ICT-based learning material and they have given more knowledge on pedagogical use of ICT through training and discussion, only few integrate ICT in to the curriculum. Most of them only increase the general use of ICT. Further, study also found that greatest impact is found from teachers who have prior experience in using ICT [20]. This has been supported by the "elearnning Nordic 2006" study which found that teachers who reported positive impact were the ones who have prior experiences in using ICT [30].

The Interactive White boards and Test bed project reported that teachers who participated in those programs were more confident in using ICT in general after the programs [23].

2.9 Teachers' ICT Skill Level

Teachers first need to acquire basic skills of ICT before they make use of ICT in teaching. The most common set of skills required by teachers to teach ICT as well as to teach other subjects using ICT can be categorized in to six main categories. They are, using and managing technology, use of specific technology, presentation skills using ICT, communication skills using ICT, advance concepts like computer programming and web technologies and pedagogical skills.

Issuing teachers a lap top computer has increased the positive attitudes towards use of technology, confidence in using technology and hands-on experience with ICT. Some teachers are reluctant to use computers and other instruments in front of students due to the fear that students are more capable of handling that equipment than them. [20]

2.10 The impact of ICT on Teaching

The most recent researches who shown the need to improve the teacher quality and enhance the teaching performance. The study conducted in both Tennessee and Texas found that quality of the teacher is one of the most important components in student's achievements. The state of the art technology brought in by ICT has the capability to enhance the teacher's quality [20].

The key findings from the ICTPD (Professional Development in Information and Communication Technology) project which conducted in UK are, ICT professional development programs directly and positively impacted on the general teaching practices of most of the participants and it had increased the teacher's effectiveness and enthusiasm for teaching. As a result of this program, teachers made significant gains in personnel competency with ICT, confidence about use of ICT with students and increase the positive attitude towards use of ICT for schools. Many teachers claimed that the ICTPD program had helped them to offer more individualized, motivating and creative teaching activities in their classrooms [31].

The evidence from the report "ICT in Schools Effect of government initiatives" shows that training programs were more successful when the school management is interest in teacher's progress in the training. However, if the schools senior management have positive attitude toward use of ICT in schools then such interventions make successful results. The study also concluded that the personnel access to computers contributed more towards the success of the training [32]. The results of the research report "A research study on usage of computers at school computer learning centers as a learning and teaching tool" concluded that use of ICT in teaching in Sri Lanka is not very successful [16].

19

2.11 Barriers for effective use of ICT

According to Elearning Nordic 2006 studies, most teachers were not using ICT in teaching because lack of ICT skills. And it also found that some cases reasons for not selecting technology in teaching was lack of required ICT skills [30]. Even though teachers' got trained through ICT competency building programs there is still lack of follow-up on utilization of acquired skill. Therefore the factors prevent teachers to utilize knowledge and skills gained ICT training has to be investigated more in future studies. Lack of ICT knowledge makes teachers less confident about using ICT. Teachers limited knowledge in ICT is also make them not to use ICT in teaching due to fear that students might have better ICT skills than them [20].

One other major factor preventing successful integration of ICT and achieving higher impact is found as inappropriate teacher training. Training courses focus mainly on developing basic ICT skills and do not train them on pedagogical aspect of ICT [31]..

School level barriers were identified in Elearning Nordic 2006 studies as follows. The absence of technology has identified as a major hindrance as availability of sufficient ICT equipment encouraged the integration of new learning and teaching methods [30]. This has been conformed by a research study carried out in Sri Lanka and it stated that less ICT infrastructure as a major issue to use ICT in schools [16]. Unreliable Internet connection, inefficiencies in telecommunication lines and slow access to web sites due to limited bandwidth were also identified as other technical barriers in the developing countries like Sri Lanka [33].

Lack of suitable educational software and unavailability of learning contents in local languages are also prevent students to get the maximum benefit ICT [20]. Further easy access to all learning materials is also a must [33]. The inability of teachers and student to use existing ICT resources due to poor management was also identified as barriers for effective use [20].

Absence of proper strategies, a clear vision and objectives for effective use of ICT in schools and lack of awareness among the school staff and the wider school community regarding the successful usage of ICT are also hindrance the ICT usage [20].

3. RESEARCH METHODOLOGY

During this research the perceived impact of ICT on learning and teaching will be investigated. This method is chosen after considering the current status of ICT in schools. Measuring actual impact is not possible as process of integrating ICT into education system is at the early stages. Therefore the chosen methodology is to get the opinion of the key stake holders of the schools regarding the impact of ICT on learning and teaching. The key stakeholders of the study are the head of the schools, students in grade ten to thirteen and their teachers. This study attempts to access the impact of ICT on learning teaching; hence this represents the perceived impact rather than actual impact.

3.1 Research Process

Figure 3.1 displays the research process followed during the study.
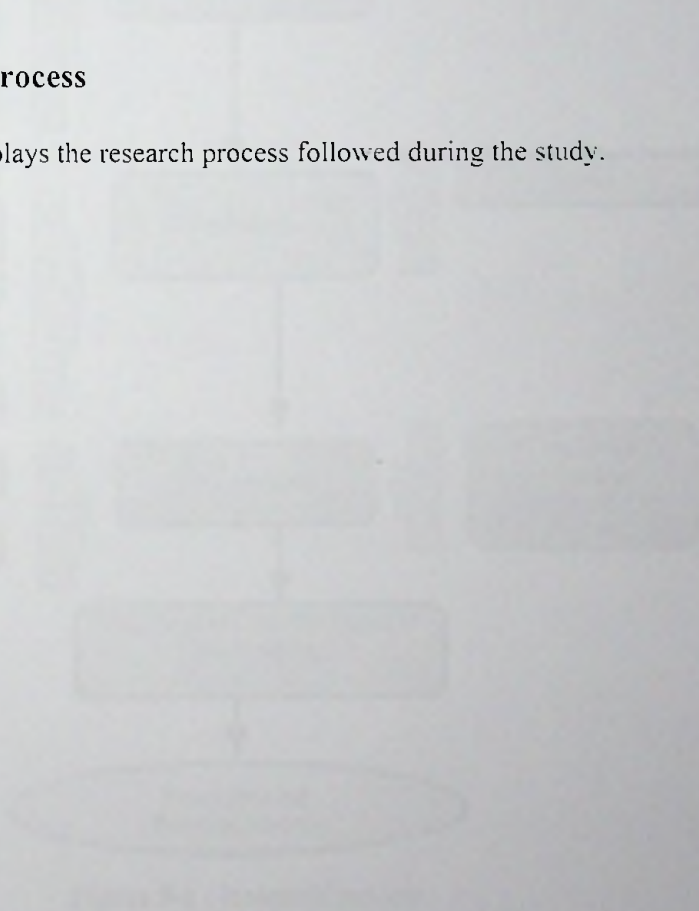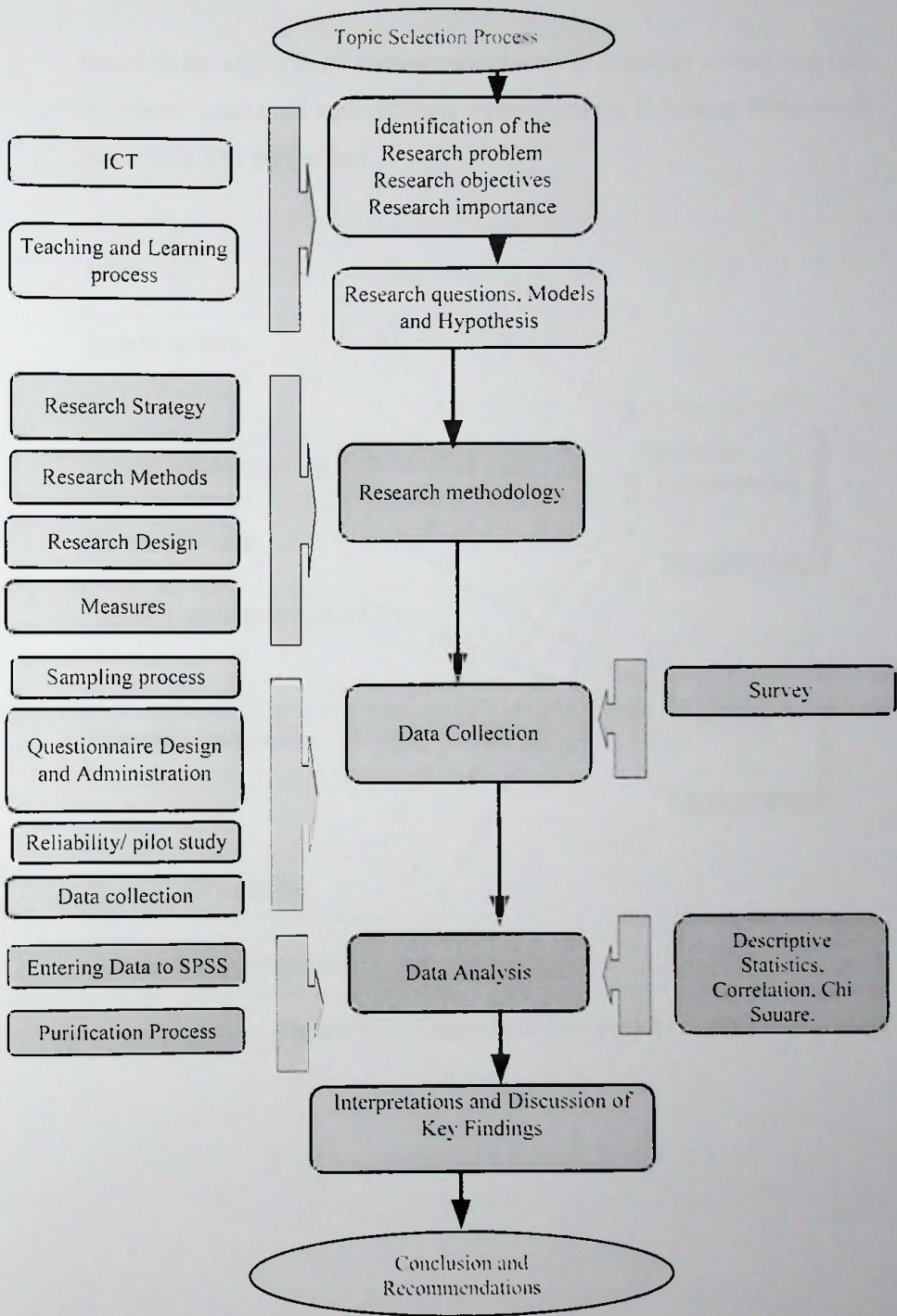
Figure 3-1 : Research process

3.2   Theoretical Framework

Based on the exploratory studies carried out via literature survey and the interviews conducted with different interest groups following theoretical framework was formulated.
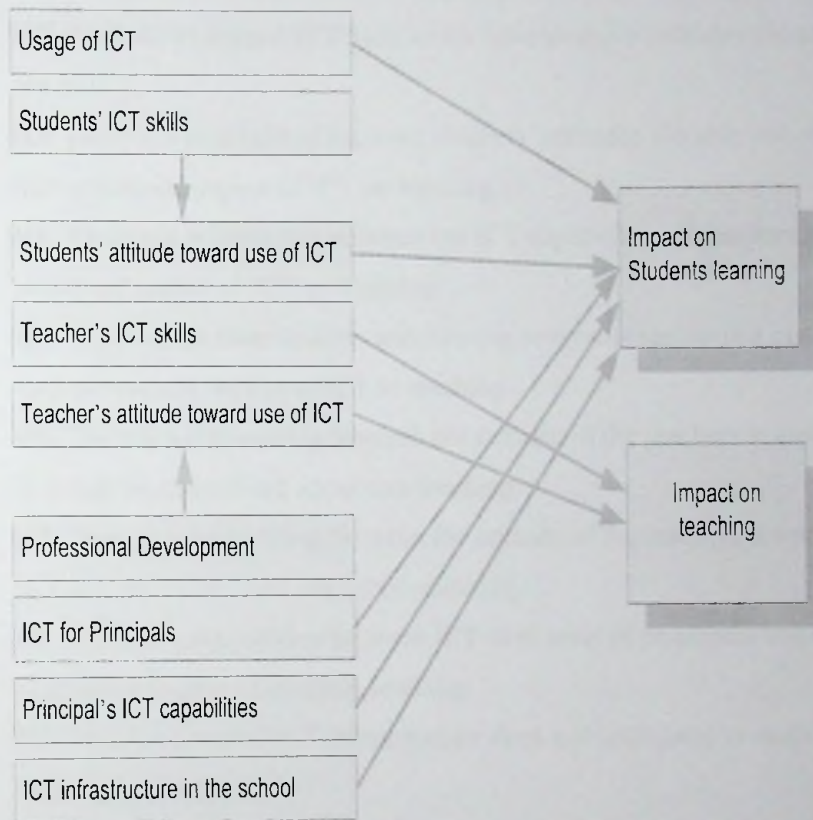

Figure 3-2 : Theoretical framework

3.3 Hypothesis

Based on the variables identified during the literature survey following hypothesis were formulated.

H1: The use of ICT has a positive impact on student's learning.

H2: Students with good ICT Skill levels have positive attitudes towards the use of ICT.

H3: There is a relationship between students' attitudes towards use of ICT and their perceived impact of ICT on learning.

H4: There is a relationship between the ICT capabilities of teachers and their perceived impact of ICT on teaching.

H5: Government interventions and training programs results in a positive attitude towards the use of ICT in teaching.

H6: There is a relationship between the attitude of the teachers towards use of ICT and their perceived impact on teaching.

H7: There is a relationship between the attitude of the teachers towards use of ICT and their perceived impact on teaching.

H8: There is a relationship between ICT skill level of principals and their experience impact on students learning.

H9: Mere presence of ICT infrastructure does not contribute to students learning outcome.

3.4   Basis of Sample Selection

Through out the survey the schools have been considered as the key unit in data gathering and analysis. Principals, teachers and students were selected randomly from the schools and data analysis was carried out at school level.

The schools under the ADB-SEMP were considered as the population. This is to make sure that all the schools under the study were equipped with minimum required ICT infrastructure. The population included 1200 schools representing 8 provinces. 80 schools are selected as the sample from the three provinces (Southern province, North Western and Uva) covering 7 districts

including urban, sub urban and rural areas. The above three provinces were selected as they were convenient for the researchers to get the permission from provincials educational directors. Provincial's educational directors in these three provinces were also very positive about the research and showed a good collaboration and willingness to help in the data collection activity. From the three provinces 80 schools were selected among schools which have CLC installed before 2005, followed by the stratified random sampling.

From each school in the sample teachers, students and principals was selected as follows.

Teachers of the senior secondary classes.
- Students in the senior secondary classes
- Principal of the school.

3.5 Research Methods

Research method is mainly through quantitative methods and qualitative data was collected depending on the need.

3.6 Research instruments

Main research instrument is selected as questionnaire by considering the limited time of the research. Interviews was used only at the initial stages of the research and during the pre survey to make sure that the reliability of the questionnaire.

Three different questionnaires were developed for each of the respondent groups.

Questionnaire 1 – Principals of the schools
Questionnaire 2 – Teachers of the schools
Questionnaire 3 – Students of the schools

3.6.1 Development of questionnaires

In the development of questionnaires, the draft questionnaires were pre tested on four selected schools and incorporated the commented on by teachers and the students.

The questionnaire were translated in to local language (Sinhala) and posted to the schools in the sample. This was done to make sure that those who do not comfortable in English language also can take part in the survey.

Measures taken to secure high response rate

The study was developed and carried with the collaboration with Secondary Education modernization Project at the Ministry of Education. Survey was carried out in two ways (Postal and Internet based) to maximize the response rate.

Students Questionnaire

87 Students in the selected three provinces (Southern, North Western and Uva) answered a questionnaire that took around 10 minutes to complete about their accesses to computers and other related ICT equipments and their familiarity with ICT. Students provided information on whether they have access to ICT in schools, and how and for what purposes they were using ICT. Furthermore, they provided information regarding their capabilities in performing certain tasks on computers, their attitude towards use of ICT for learning and their perception about the impact of ICT on learning and teaching process. Students also provided information about their experience in using computers.

Teachers Questionnaire

79 school teachers completed a questionnaire regarding their professional development in the area of ICT, the confidence in performing certain tasks on computers and their experience level in using ICT. As a part of this questionnaire teachers were asked about their attitude towards the use of ICT and perception about the impact of ICT on learning and teaching process.

Finally they were asked to rank the most significant five drivers and barriers for effective use of ICT in their schools.

Principals Questionnaire

Questionnaire given to 80 school principals provided information on demographic characteristics and availability of ICT infrastructure, availability of ICT human capital and the extent to which ICT is integrated into the school. However only 48 principals posted back the completed the questionnaire. As a part of this questionnaire principals were asked to comment about their ICT experience and leadership activities which helped schools to implement ICT in a successful manner. Finally they were asked to rate the set of identified drivers and barriers which are significant for their school.

The results are presented in the chapter 4 and the complete questionnaires are included in the appendix for reference.

3.6.2 Practical implementation of questionnaire-based survey

Postal questionnaire

Three separate questionnaires (Questionnaire 1 – Principals of the schools, Questionnaire 2 – Teachers of the schools and Questionnaire 3 – Students of the schools) were posted to all 80 schools with a covering letter from the provincial project director of the SEMP. The principal of the school was asked to get students and teachers to fill the questionnaire according to the instructions given and also fill it him/her self as well. And they were requested post the completed package using the stamped envelops that were provided.

4. FINDINGS

Data analysis was carried out using SPSS version 13 [34]. A total 214 persons (teachers, students, principals) have participated in the survey representing different views on impact of ICT on learning and teaching. 48 responds received out of 80 questionnaires (60%), 79 responds received out of 140 questionnaires (56%), 87 responds received out of 140 questionnaires (62%) posted to principals, teachers and students respectively. The findings of the survey are based on the data collected from the only three provinces of the country. (Southern, North West and Uva.)

Fist section analyses the students' data, second section analyze the teachers' data, third section analyses the principals' data and final section presents the current ICT usage in Schools in general.

4.1 Students

First section provides sample demography. Second sections discusses about the student's access to ICT resources at school. their ICT skills and experiences and students attitude towards computers. Third section presents the results of hypothesis 1, 2 and 3, examining information provided by students.

4.1.1 Sample demography

Age distribution

Figure 4-1 shows the age distribution of the students in the sample. According to the sample selection criteria students were selected among the senior secondary classes, therefore the age distribution of the sample is within the age range of 15 years to 18 years.

Figure 4-1 : Age distribution of the sample

Gender distribution of the sample

Figure 4-2 shows the gender distribution of the students in the sample According to the responses, numbers of male and female respondents are more or less equally distributed.
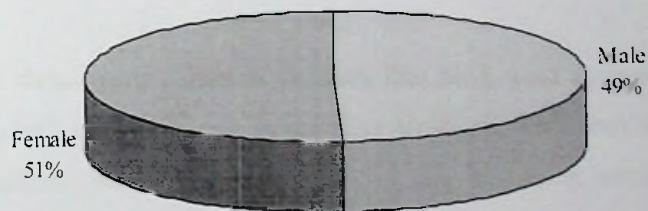

Figure 4-2 : Gender distribution of the sample

4.1.2 Students computer access

The first aspect of the computer access is whether students use computers at all.

No of schools

| | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |

No of Students have used computers

Students have access to computers at CLC

Students have access to computers at home

Students have access to computers at class room
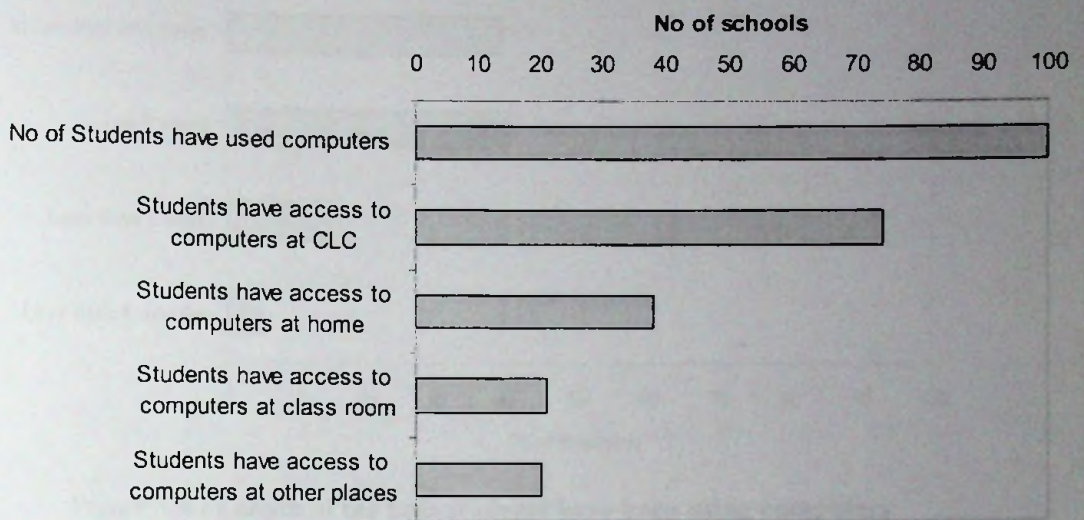
Students have access to computers at other places

Figure 4-3 : No of students who have used computers and have access to computers

Figure 4-3 shows percentages of students that have used computers and the availability of computer access at different locations. This shows that almost all the students used computers and they are accessing computers from different locations. Majority of students have accessed them from Computer Learning Centers (CLC) located at schools.

The second aspect of computer access is how long students have been using computers. According to figure 4-4, all most all the students have prior experience in using computers and their experience differ slightly from one student to another. Majority of students have used computers for more than one year. Only 5% of them were beginners.
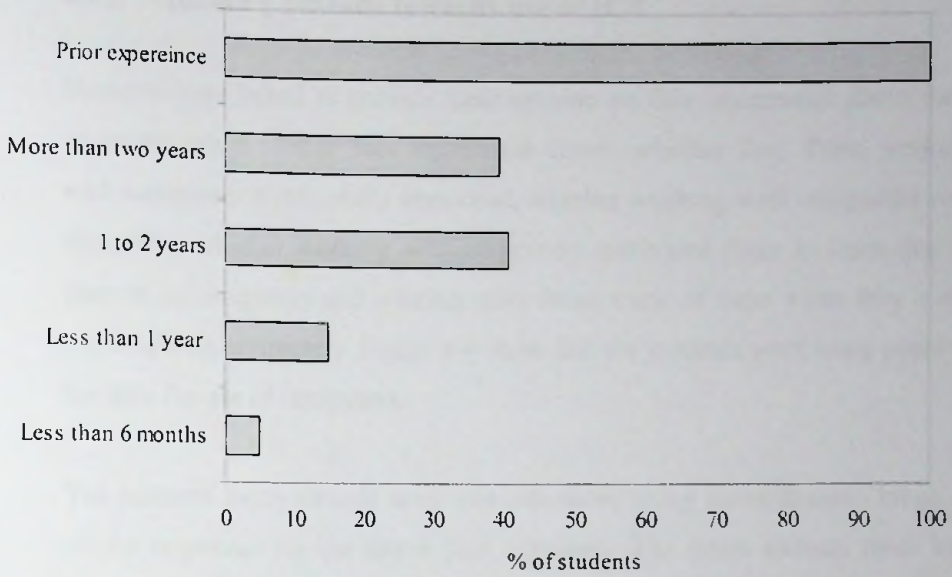
31

Figure 4-4 : **Length of the time students have been using computers**

Third aspect is to analyze the present computer usage of students. Students were asked to provide the average number of hours they use computers per week. More than 80% of students were using computers more than one hour (Figure 4-5).
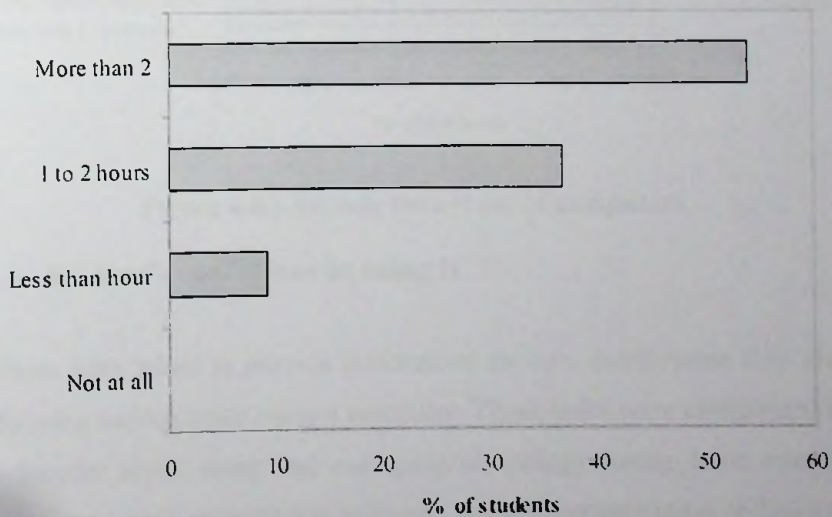

Figure 4-5 : Number of students using computers during a week

4.1.3 Student's attitude towards use of ICT

Students were asked to provide their opinion on four statements about their computer usage. These four statements cover, whether they think working with computers were really important, whether working with computers was enjoyable, whether working with computers motivated them to learn due to interest in computers and whether they loose track of time when they were working with computers. Figure 4-6 show that the students were more positive towards the use of computers.

The students mean attitude level was calculated using the arithmetic mean of all the responses for the above four questions. The mean attitude level was around 4-3 on the five point scale.
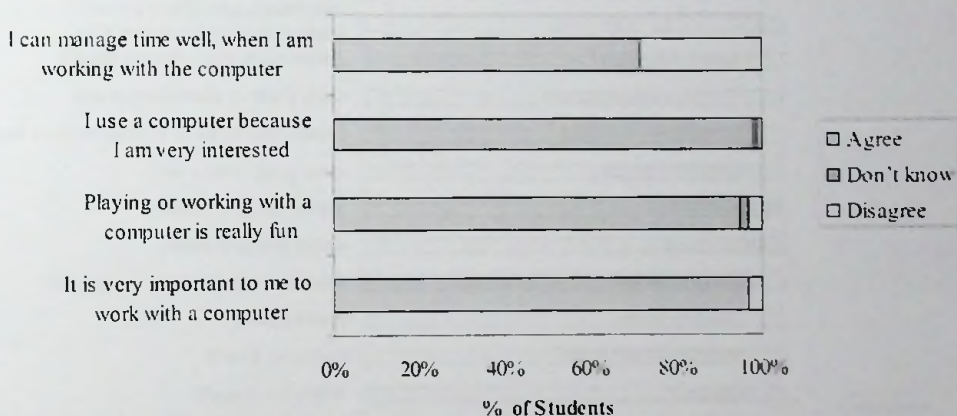

Figure 4-6 : Attitude toward use of **computers**

4.1.4 Student's confidence in using ICT

Students were asked to provide information on how comfortable they are in performing various tasks using a computer. These tasks were categorized into five broader areas: using and managing technology, using basic computer applications, using presentation software, using communication technologies and advanced concepts.

According to the figure 4-7 majority of students have basic skills which require managing the technology. Around 10% of them are not capable to create/edit or save a document. Skills in use of basic computer applications such as word and excel is also at a higher level. However most of the students are lacking communication technologies such as email and the internet and the skills in the advanced computer applications like web page designing, database and computer programming.
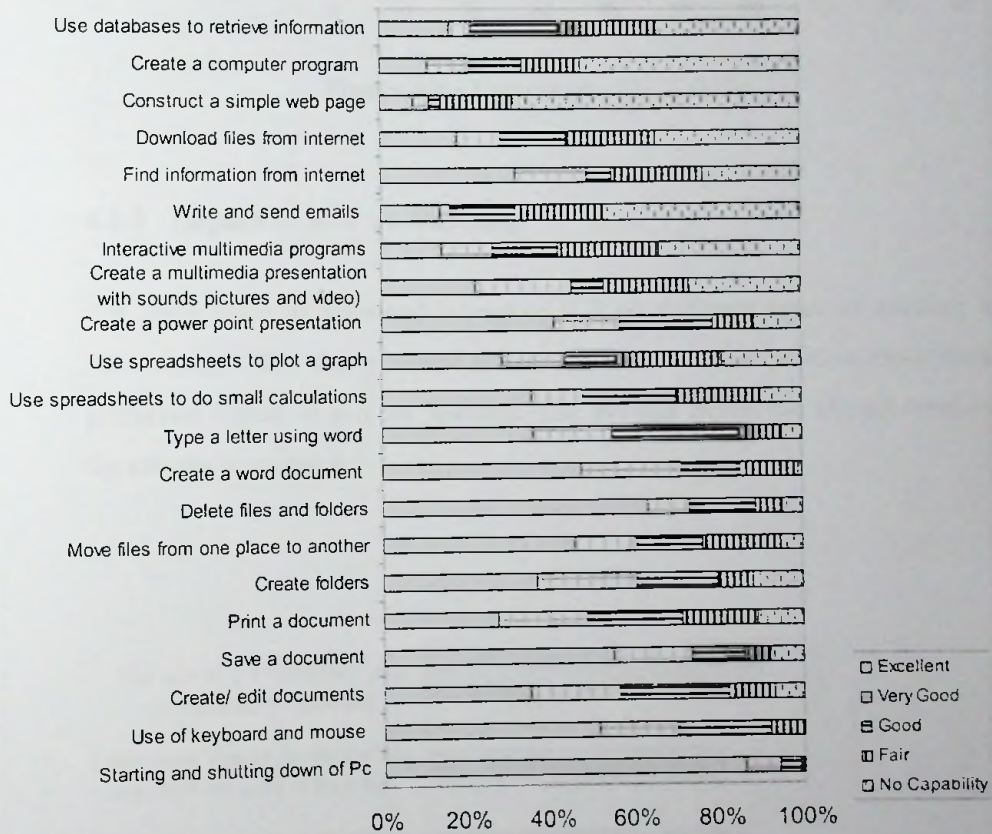

Figure 4-7 : ICT skills

Further, responses for these questions can be presented in the following figure. It categorizes the skills listed in figure 4-7. The average skill level of the sample is as high as 4.4 on the five point scale.
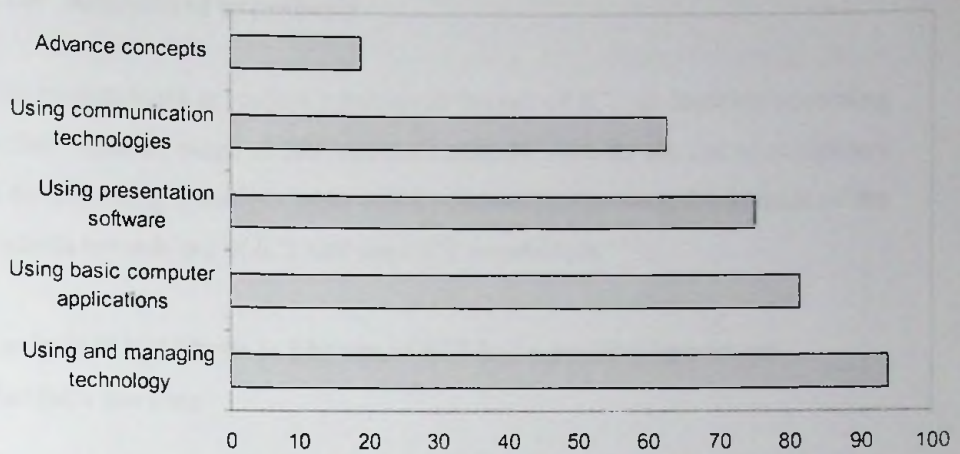
Figure 4-8 : Categories of ICT skills

4.1.5 Impact of ICT on learning

The mean value of perceived impact of ICT on different areas of learning is shown below. The data revealed that students were more positive about their perceived impact of ICT on learning. The average perceived impact level of the sample is around 4.2.
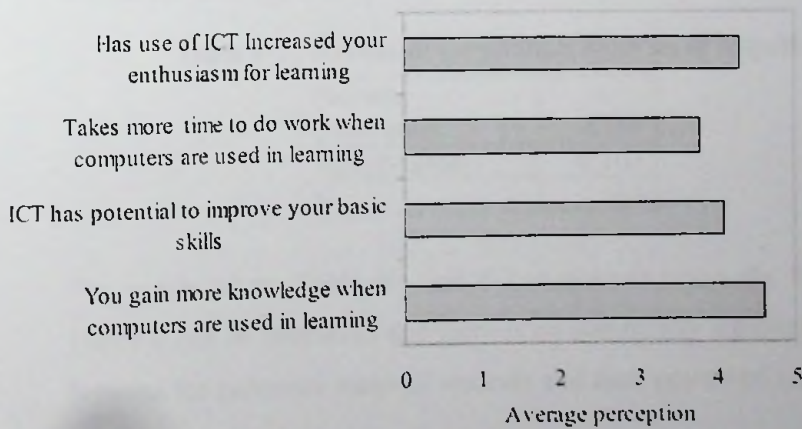

Figure 4-9 : Perceived impact of ICT on learning

4.1.6 Analysis of hypothesis

This section looks at student's perceived impact of ICT on learning according to their reported usage of ICT and their attitude towards the use of computers in their learning. Finally it looks at the relationship between the attitude of the students towards use of ICT and their ICT capabilities.

Analysis of hypothesis 1: The use of ICT has a positive impact on student's learning

Two aspects of computer access - whether they have a computer available to do their school work, and how many hours they use computers during school time were considered. The results of the correlation analysis of the number of hour's students use computers and their perceived impact is shown below Table 4-1.

Table 4-1 : Results of correlation analysis of hypothesis 1

Pearson Correlation	-0.055
Sig. (2-tailed)	0.637
N	75

The results of the correlation analysis of the availability of computer access at school and their experience impact are shown below Table 4-2.

Table 4-2 : Results of correlation analysis of hypothesis 1

Pearson Correlation	0.180
Sig. (2-tailed)	0.105
N	82

The results of the Table 4-1 and 4-2 support to reject the first hypothesis. Hence it can be concluded that there is no statistically significant relationship between the computer usage of students and their perceived impact of ICT on learning.

Analysis of hypothesis 2: Students with good ICT skill levels have positive attitudes towards the use of ICT.

Next let's look at how the students' ICT skills are related to their attitudes towards use of ICT..

Table 4-3 : Results of correlation analysis of hypothesis 2

Pearson Correlation	0.721
Sig. (2-tailed)	0.000
N	67

According to the results in Table 4-3, the relationship between the student's ICT skill level and perceived impact was found to be statistically significant at the 99% confident interval.

Regression analysis was carries out to see whether student's perception about impact of ICT on their learning is a function of their ICT skill level. From the results in the Table 4-4, it is found that students who have strong ICT skills tend to perceived more impact of ICT on their learning.

Table 4-4 : Results of regression analysis of hypothesis 2

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.561353	0.205795		12.44615	0.000
	SKILLS	0.485774	0.057934	0.720841	8.384945	0.000

The results of the correlation analysis presented in Table 4-3 and regression analysis presented in Table 4-4 lead to accept the second hypothesis. Hence it can be stated that students with good ICT skill levels tend have positive attitudes towards the use of ICT.

Analysis of hypothesis 3: There is a relationship between student's attitude towards use of ICT and their perceived impact of ICT on learning

Finally it looks at how the students attitudes towards use of ICT relates to the perceived impact of ICT on learning. A result of the correlation analysis is shown Table 4-5.

Table 4-5 : Results of correlation analysis of hypothesis 2

Pearson Correlation	0.661
Sig. (2-tailed)	0.000
N	82

The relationship between the student's attitude towards use of ICT and their perceived impact was found to be statistically significant at the 99% confident interval.

The Table 4-6 shows the results of regression analysis and according to that, students' perceived impact of ICT on learning is found to be a function of their attitude toward use of technology in learning.

Table 4-6 : Results of regression analysis of hypothesis 3

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
						0.000
1	(Constant)	1.804603	0.334296		5.39821	
	Attitudes	0.555146	0.076762	0.628748	7.23202	0.001

The results of the correlation analysis presented in Table 4-5 and regression analysis presented in Table 4-6 lead to accept the third hypothesis. Hence it can be stated that There is a statistically significant relationship between student's attitude towards use of ICT and their perceived impact of ICT on learning.

4.2   Teachers

First section provides sample demography. Second section shows how teachers use ICT, their ICT skills and their attitudes towards use of technology. Third section presents the results of hypothesis 4, 5 and 6, examining information provided by teachers.

4.2.1   Sample demography

Figure 4-10 shows the age distribution of the teacher's sample. According to the figure most of the teachers who took part in this survey was around 30-40 years and 40-50 years.
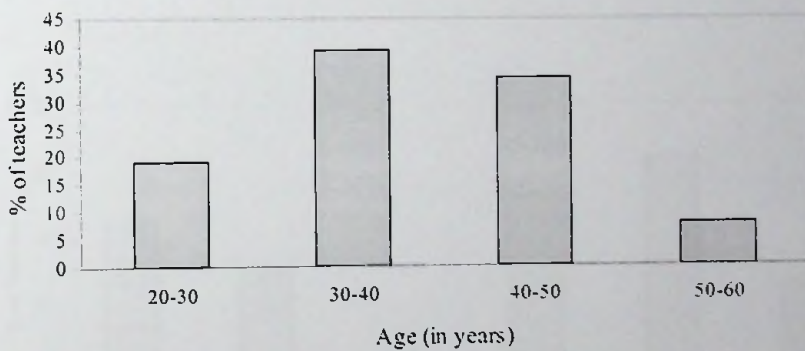
Age distribution of the sample

Figure 4-10 : Age distribution of the sample

Gender distribution of the sample

Sample consists of 52% male teachers and 48% female teachers.
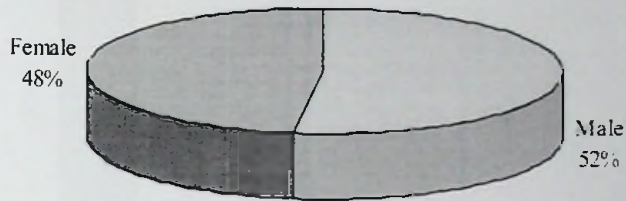
Figure 4-11 : Gender distribution of the sample
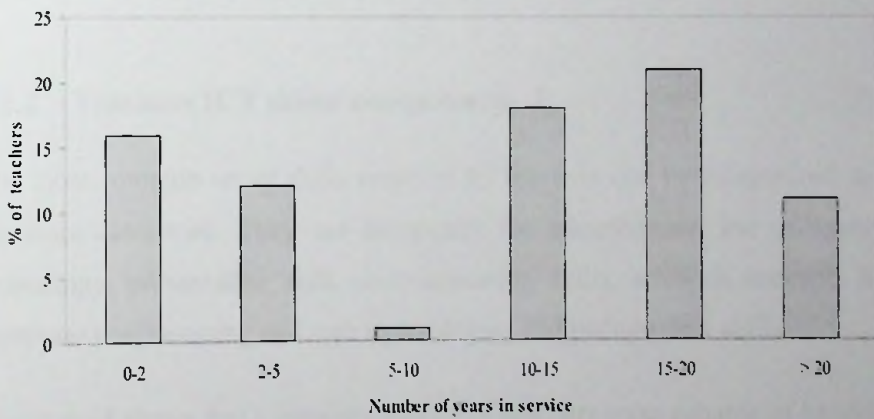
Experience Level

Figure 4-12 : Number of years in service

According to the figure 4-12 majority of teachers have 15-20 years of experience in teaching.
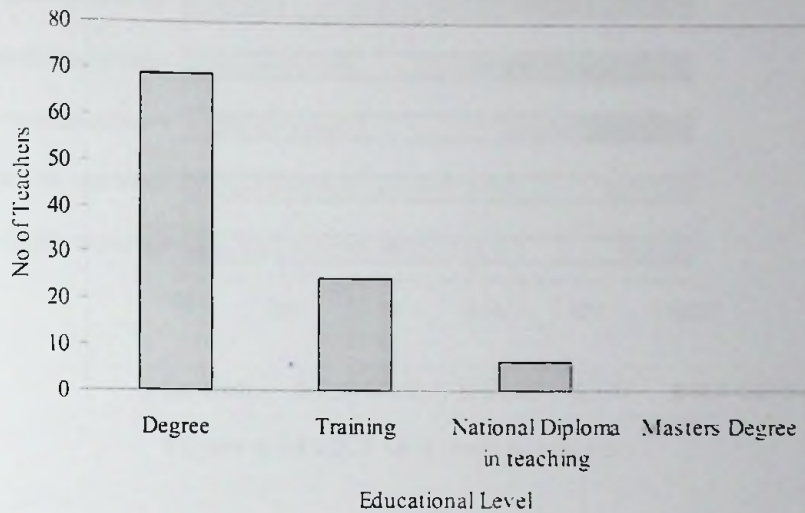
Educational background

Figure 4-13 : Educational background of the teachers

69% of the teachers were degree holders and 25% them were trained teachers and very few were holding the national diploma in teaching.

4.2.2   Teachers ICT skills/ competency

The most common set of skills required by teachers can be categorized in to six main categories. They use computers for management, use of specific technology, presentation skill, communication skills, advance concepts like computer programming and web technologies and pedagogical skills.

Figure 4-14 shows that a greater majority of teachers were capable of handling technology to a greater extent. The pedagogical related skills were lacking from the majority of the teachers. Teachers were generally competent in using basic computer application and using presentation software.
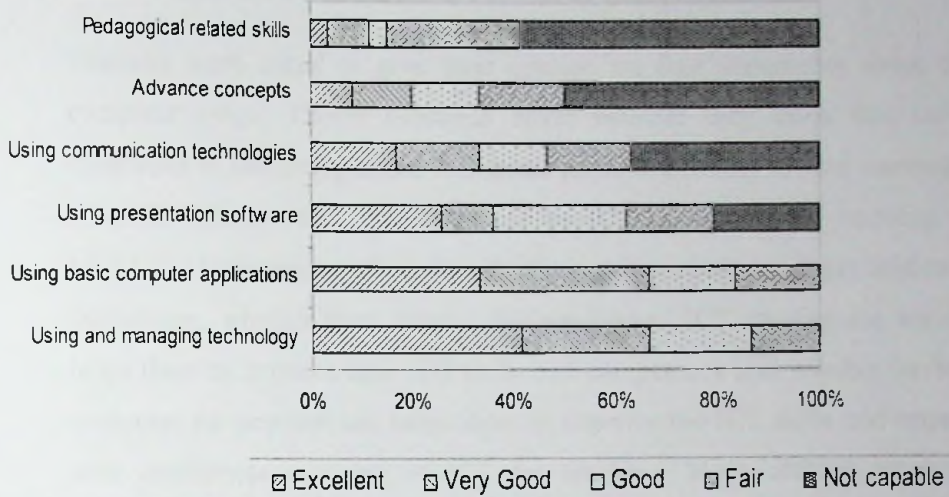
Figure 4-14 : ICT skill level of teachers
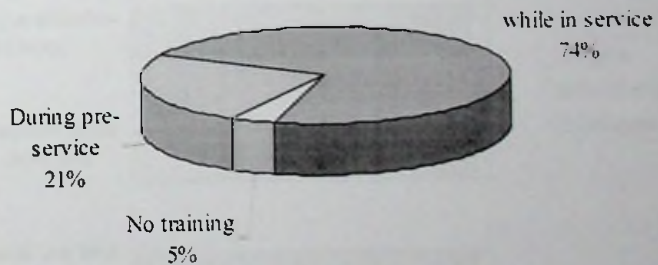
4.2.3 Professional development

Figure 4-15 : ICT training

Majority of teachers have participated in some kind of ICT training. 74% of teachers have participated in training while in service. However, around 5% of the teachers have not participated for any kind of ICT competency development programs.

4.2.4   Attitude of the teachers towards use of ICT

Teachers were asked to give their opinion on four statements about their computer usage. Theses questions cover whether they think that use of computers in teaching process will create positive attitudes toward learning by students, whether they think that use of ICT in schools for learning and teaching wastes time as it take lot of time to prepare notes and get used to the technology, whether they believe that providing ICT training for teachers helps them to improve their ICT skills and competency and whether having a computer for personal use helps them to improve the ICT skills and improve their confidence in using of ICT for teaching. Mean attitude level was calculated using the arithmetic mean of all the responses and it was around 4.2. This shows that teachers have positive attitude toward using of computers in teaching and learning process.
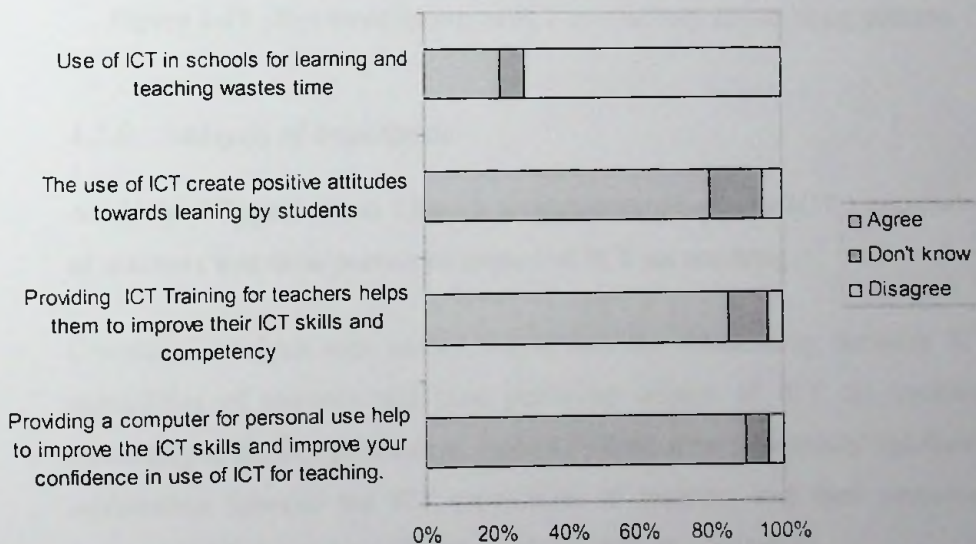

Figure 4-16 : Attitude of teachers toward use of computers

4.2.5 Perceived impact on teaching

Teachers were asked three questions regarding their perception of use of ICT in teaching, which covers different areas of teaching and mean was calculate using the arithmetic mean of all the responses.
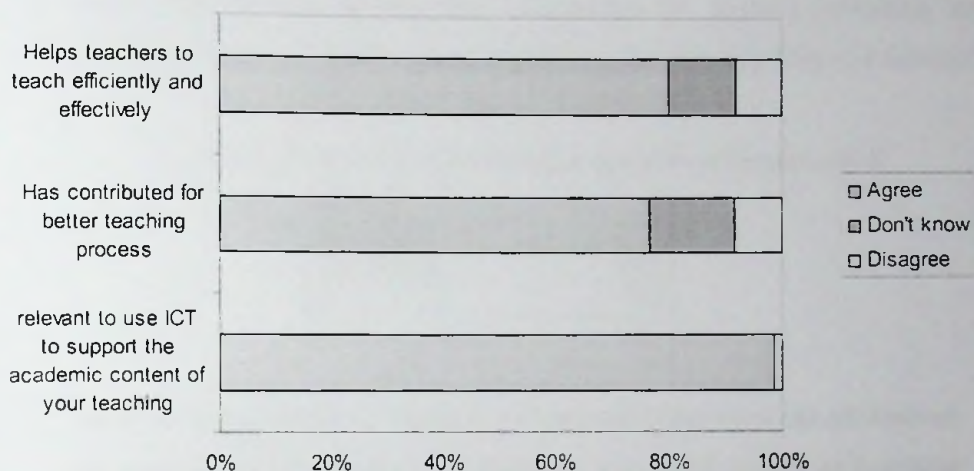

Figure 4-17 : Perceived impact of ICT on teaching and learning process

4.2.6 Analysis of hypothesis

Analysis of Hypothesis 4: There is a relationship between ICT capabilities of teachers and their perceived impact of ICT on teaching.

Correlation analysis was carried out to test the relationship between ICT capabilities of teachers and their perceived impact of ICT on teaching. According to the data provided in Table 4-7, there is no statistically significant relationship between the ICT capabilities of teachers and their perceived impact of ICT on teaching. Hence fourth hypothesis is rejected.

Table 4-7 : Results of correlation analysis of hypothesis 4

Pearson Correlation	.210
Significance	0.105
N	61

Analysis of Hypothesis 5: Government interventions and training programs results in a positive attitude towards the use of ICT in teaching

The correlation analysis of the relationship between ICT training provided for the teachers and their attitudes towards use of ICT in teaching shown in the Table 4-8. According to the results there is no statistical significant relationship between government intervention in training programs and attitude towards use of ICT in teaching. Hence the fifth hypothesis is rejected.

Table 4-8 : **Results of correlation analysis of hypothesis 5**

Pearson Correlation	-213
Significance	0.69
N	74

Analysis of hypothesis 6: There is a relationship between the attitude of the teachers towards use of ICT and their perceived impact on teaching

According to the results of the correlation analysis presented in Table 4-9, there is a relationship between the attitude of the teachers towards use of ICT and their perceived impact on teaching.

Table 4-9 : **Results of correlation analysis of hypothesis 6**

Pearson Correlation	0.995
Significance	0.000
N	73

Regression analysis was used to determine whether teachers' perceived impact is a function of the teacher's attitude toward use of ICT.

Table 4-10 : **Results of the regression analysis of hypothesis 6**

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-0.132800553	0.139779803		0.950069683	0.345
	attitudes	1.029090512	0.038113405	0.954596506	27.00074952	0.00

From the results presented in Table 4-10. it can be stated that teachers' perceived impact is a function of the teacher's attitude toward use of ICT.

The results of the correlation analysis presented in Table 4-9 and regression analysis presented in Table 4-10 lead to accept the second hypothesis 6. Hence it can be stated that there is a statistically significant relationship between the attitude of the teachers towards use of ICT and their perceived impact on teaching.

Principals

This section discusses about the relationship between ICT skill level of the principals and their perceived impact on teaching and learning and the relationship between the ICT training provided for principals and their perceived impact of ICT on learning.

4.3.1 ICT skill level

The following diagram shows the ICT skill level of the principals. Skills are categorized into four main categories and most of the principals were very confident about their knowledge on handling the technology. It can be seen that most of the principals are not very fluent in using communication technologies such as Internet and Email.
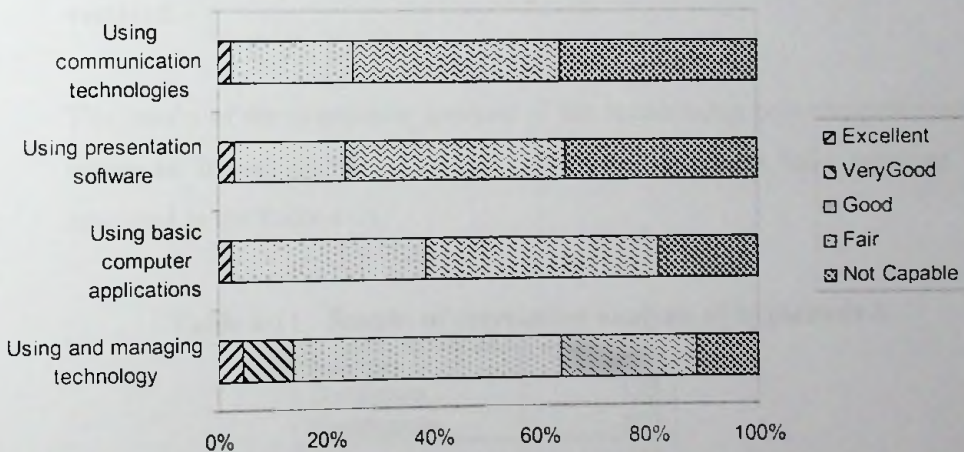

Figure 4-18 : ICT skill level

4.3.2 ICT training

About 71% of the principals have received ICT training and 56% of the principals were participated in E-Citizen training program conducted by the Ministry of Education.
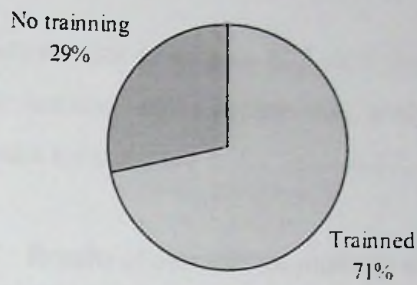
Figure 4-19 : ICT training

4.3.3   Analysis of hypothesis

**Analysis of hypothesis 7: There is a relationship between principals'
perceived impact of ICT on students learning and training they have
received.**

The results of the correlation analysis of the relationship between principal's
perceived impact on students learning ICT training they have received in
tabulated in the Table 4-11. .

Table 4-11 : Results of correlation analysis of hypothesis 6

Pearson Correlation	.123
Significance	.503
N	44

The non existence of the relationship is evident from the .123 of Pearson
correlation coefficient and significance of .503. Therefore the hypothesis 7 is
rejected. Hence it can be stated that there is no statistically significant
relationship between principals' perceived impact of ICT on students learning
and training they have received

Analysis of hypothesis 8: There is a relationship between ICT skill level of principals and their experience impact on students learning.

The relationship between the principals ICT skill level and their perceived impact on students learning and teaching was analyzed using correlation analysis and the results are tabulated in the Table 4-12.

Table 4-12 : **Results of correlation analysis of hypothesis 7**

Pearson Correlation	.559
Significance	0.001
Confidence	99 %
N	36

A simple linear regression was performed to find out whether the perceived impact is a function of their ICT skill level. The regression test results are presented in the Table 4-13.

Table 4-13 : Results of the regression analysis of hypothesis 7

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.230293	0.243064		13.2899	0.000
	AvgSkills	0.383371	0.105717	0.558563	3.626389	0.001

From the regression results it can be seen that principals perceived impact of ICT on students learning is a function of their ICT skill level. Hence hypothesis 8 is accepted and it can be stated that there is a statistically significant relationship between ICT skill level of principals and their experience impact on students learning

Analysis of hypothesis 9: Mere presence of ICT infrastructure does not contribute to students learning outcome

The relationship between the ICT infrastructure in the school and the principal's experience impact on student learning was analyzed. According to the data presented in Table 4-14, it can conclude that there is no relationship between ICT infrastructure and the perceived impact on students learning.

Hence the hypothesis is accepted and it can be stated that mere presence of ICT infrastructure does not contribute to students learning outcome

Table 4-14 : Results of correlation analysis of hypothesis

Pearson Correlation	.226
Significance	0.148
N	44

4.4 Analysis of drivers and barriers

This section analyses the drivers and barriers for effective use of ICT in schools according to data provided by the teachers and principals. Tables 4-15, 4-16, 4-17 and 4-18 outlines the total number of responses obtained for the rank of each driver/barrier. Rank 1 denotes the highest significant driver/barrier while rank 5 denotes the least significant driver/barrier. The grayed box in each row shows the most suitable rank of each driver/barrier which can be assigned based on the number of responses.

4.4.1 Drivers and barriers according to teachers' responses

Drivers

Table 4-15: Drivers - According to teachers' responses

Driver	Rank 1	Rank 2	Rank 3	Rank 4	Rank 5
1	11	14	2	11	7
2	12	11	15	3	11
3	5	6	13	17	3
4	7	10	13	9	8
5	12	5	8	8	13
6	7	7	5	7	9
7	1	6	8	7	5
8	17	12	7	9	6
9	2	1	1	4	6

According to the above analysis, most of the teachers think that following are the most significant five drivers for effective use of ICT in schools.

1. Pupils' motivation for using ICT
2. A clear vision of use of ICT in school is communicated to all levels of staff and the Wider school community
3. Clear objectives for use of ICT at the school is being set by the school heads and the responsible authorities
4. Easily accessible ICT equipment
5. Availability of sufficient, good selection of interesting learning software

Barriers

Most significant five barriers for achieving greater impact of ICT in learning and teaching were analyzed according to the data provided by teachers.

Table 4-16: Barriers – According to teachers' responses

Barrier	Rank 1	Rank 2	Rank 3	Rank 4	Rank 5
1	10	1	6	6	3
2	3	1	2	5	0
3	3	7	1	2	0
4	0	4	6	2	0
5	15	2	7	3	10
6	5	4	5	3	2
7	1	10	7	1	4
8	4	8	8	3	5
9	5	11	9	6	5
10	9	7	3	6	5
11	5	6	2	8	8
12	0	0	0	2	4
13	5	6	9	4	5
14	3	6	8	5	6
15	2	2	0	6	3
16	5	0	0	9	7

According to the above analysis, majority of the teachers think that following are the most significant five drivers for effective use of ICT in schools.

1. Non functional ICT equipment and inefficiencies in maintain and obtaining technical support
2. Unavailability of learning contents not in the local language to promote better use of ICT
3. Lack of basic ICT skills among teachers
4. Heavy cost for maintaining and obtaining technical support
5. Teacher's lack of understating of why they should use ICT in teaching

4.4.2 Drivers and barriers according to principals' responses

Drivers

Table 4-17: Drivers - According to principals' responses

Driver	Rank 1	Rank 2	Rank 3	Rank 4	Rank 5
1	7	1	6	3	3
2	9	5	1	1	4
3	0	5	2	3	5
4	12	7	6	9	4
5	4	3	4	2	0
6	1	2	1	4	0
7	2	5	3	5	5
8	0	2	8	3	1
9	2	1	6	1	5
10	3	7	1	7	2
11	4	3	2	1	4
12	3	5	4	3	10
13	0	2	3	6	4
14	1	0	1	0	1

According to the above analysis the most significant five drivers for effective use of ICT in schools were identified as follows.

1. Teachers believe that ICT can use as a teaching tool.
2. Teachers have good understanding about why they should use ICT how exactly they can use ICT to help them teach better.
3. The learning contents is in the local language and it promotes better use of ICT
4. Pupils' motivation for using ICT.
5. Teachers' motivation for using ICT in teaching.

Barriers

Table 4-18: Barriers - According to principals' responses

Barrier	Rank 1	Rank 2	Rank 3	Rank 4	Rank 5
1	1	0	2	0	4
2	5	0	0	0	1
3	2	3	0	0	3
4	1	3	2	0	0
5	10	8	6	1	3
6	4	11	6	6	2
7	3	3	3	4	5
8	3	5	4	3	3
9	8	2	1	13	4
10	1	2	4	2	4
11	1	5	3	4	1
12	1	3	8	2	1
13	1	3	3	4	8
14	2	0	2	0	3
15	2	1	2	7	4

According to the above analysis the most significant five barriers for effective use of ICT in schools were identified as follows.

1. Non functional ICT equipment in the school and inefficiencies in maintain and obtaining technical support.

2. English is the dominant language of the Internet. It is serious barrier to maximizing the educational benefits of the World Wide Web.

3. Insufficient ICT professional development for all levels of Staff.

4. Lack of basic ICT skills among teachers.

5. Lack of skills with particular computer applications. (e.g.-PowerPoint word processing)

4.5 Current ICT Usage in Schools

This section discusses about the current ICT usage level of the schools and on the findings of the research study. First it looks at the ICT infrastructure level of the schools both in terns of physical ICT resources and ICT human capital. Then it examines the computer usage of both students and teachers

4.5.1 The extent of ICT resources available at school

This section examines the ICT infrastructure level of the schools. First it looks at the physical ICT resources (most common types of ICT equipment used in schools) availability, current computer student ratio. SchoolNet facility and the human ICT resources level of the schools according to the data provided by the school principals.

According to the Figure 4-19, vast majority of schools have computer learning centers, school net facility and other basic ICT infrastructure. Multimedia accessories and multimedia projectors do not seen as very common in schools. Educational software and other learning materials in electronic format are also very rare in schools. Overhead projectors. radio cassettes and TV are commonly used in these schools.
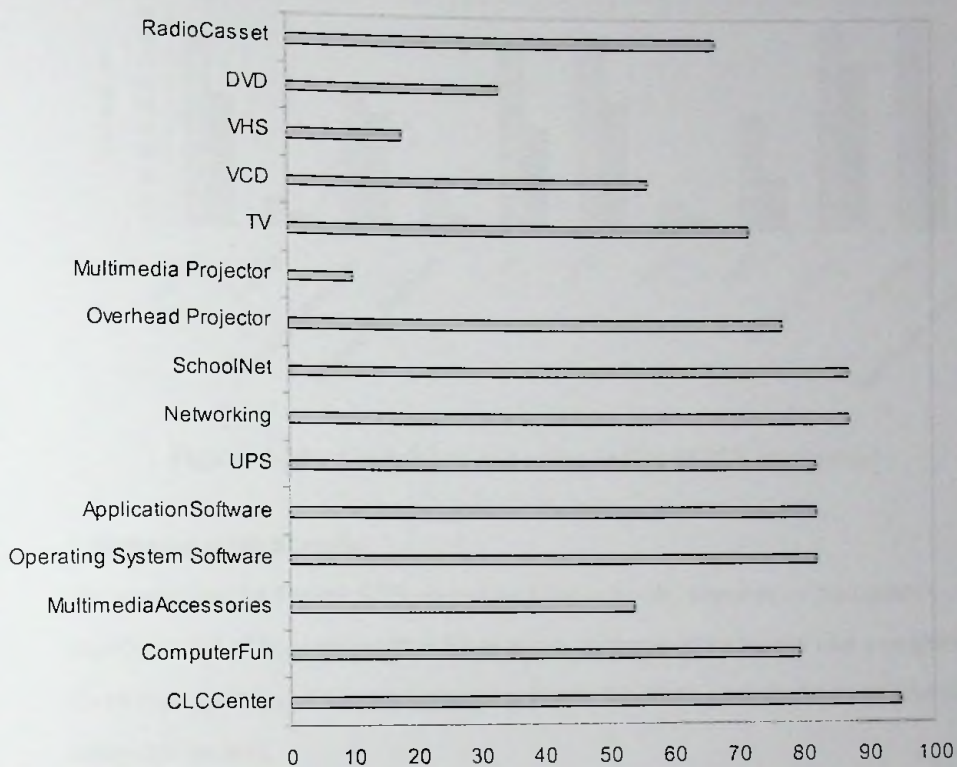
Figure 4-19 : Availability of ICT infrastructure

Secondly it looks at the availability of those equipments for student's use according to the students responses.

Availability and Accessibility of Different kind of ICT equipment

The Figure 4-20 shows the availability and accessibility of different kind of ICT equipments. Not many students reported having access to educational software at school. More than 90% of the students have access to computers and radio cassettes while almost all the students have some kind of access to computers and others ICT resources at school. The above figure clearly shows that students are not able to get the maximum benefit from the prevailing ICT resources at the school. Schools are not utilizing their ICT resources to their maximum potential.
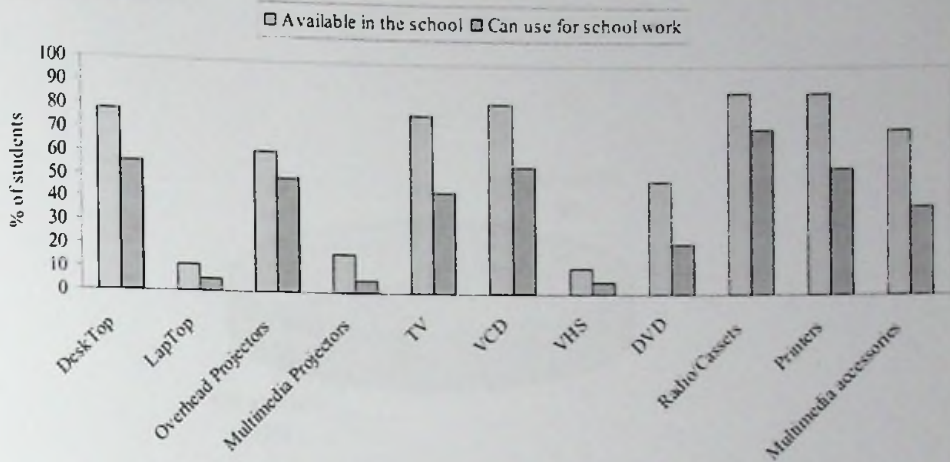
Figure 4-20 : Availability and accessibility of ICT equipment

Computer student ratio

According to the Figure 4-21, in most of the schools. number of computers per student is 0.1. This implies that 10 or more students have to use one computer. Even though it is not common, some schools facilitate two students to use one computer as well.
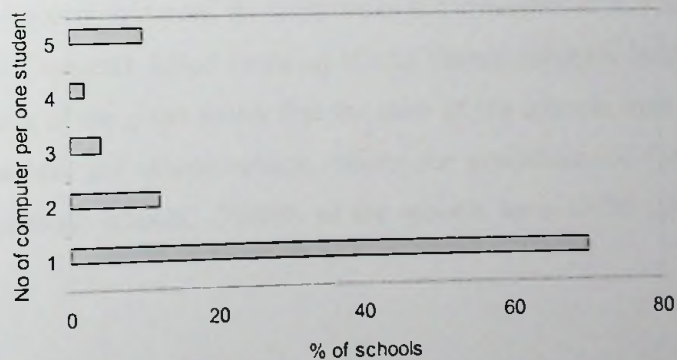
Figure 4-21 : Number of computers per student

SchoolNet Facility
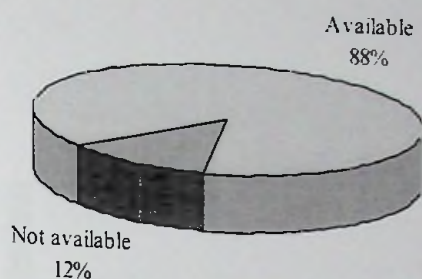
Figure 4-22 : Availability of SchoolNet

SchoolNet facility is very common among the schools and it is around 88% of the sample.

ICT human resources

In terms of human resources, the study looks at the number of ICT trained and number of Computer Aided Learning (CAL) trained teachers in the school. First column of the graph shows that the most of the schools have 0-10 ICT trained teachers and second column shows the availability of CAL trained teachers in those schools. 30-40% of the schools have 10-20 CAL trained teachers.
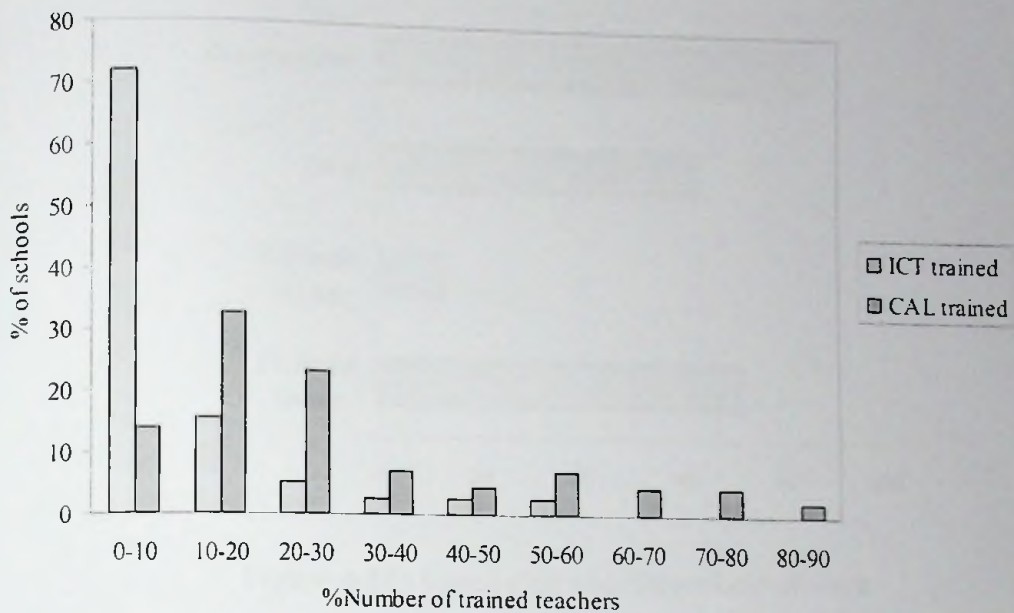
Figure 4-23 : Number of ICT and CAL trained teachers in schools

4.5.2   Student's computer use

This report sheds light on how students in secondary classes use computers and for what purposes they use computers.

Student's prior experience in using computers were take as background information and found that around 40% of the students have more than 2 years of experience. The Figure 4-24 shows students responses on what purposes they use computers. Greater majority of students use them for entertainment whereas 60% of them use it for excel and more than 80% of them use it for documentation purposes. The figure shows that very few numbers of students have use computers for web page design.
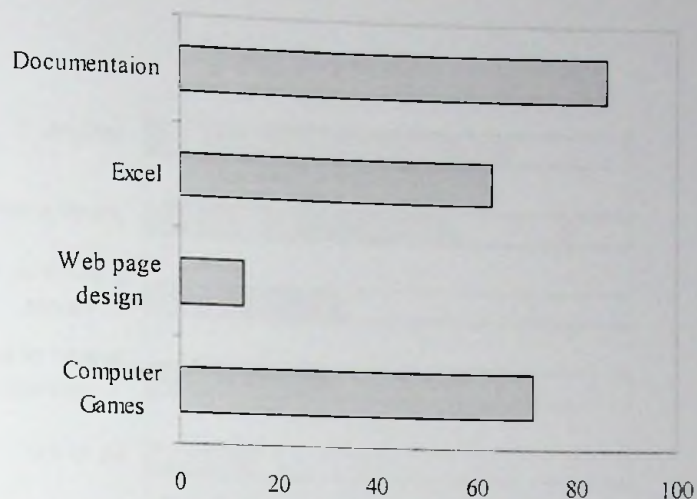
Figure 4-24 : Experience in different kind of work

Frequency of use of ICT by pupils for learning purposes

This section examines how frequent student use computers for doing school work. Students were asked questions about how frequently they used computers to perform various types of functions under four categories. Informative: To find and acquire information from SchoolNet and other educational CD's. Functional: The use of existing information for doing schoolwork. Creating: To compose, compile and produce new information, write papers, create presentations and write software programs. Communication: To exchange and transmit information with other students and teachers using Email, internet chat, forums or through the SchoolNet.

Majority of students use computers every day either to find information or to create something using already available data. More than 50% don't use computers to communicate at all.
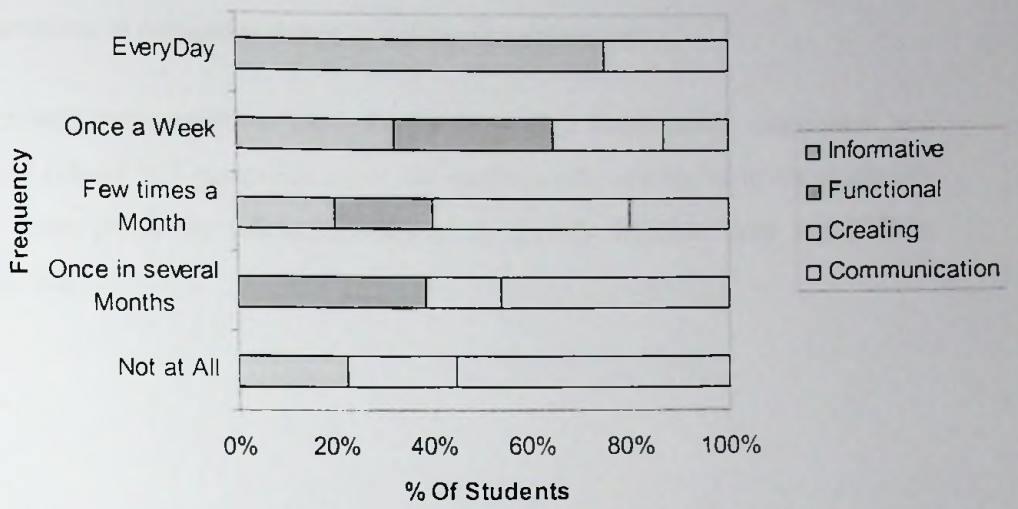
Figure 4-25: Frequency of access at each location

4.5.3 Teacher's computer use

Variation in computer usage in different subject areas

Teachers were asked to mark the subjects they teach using computers and other related ICT equipments. For the teachers who are teaching for grade 10-11 were given the following subjects to specify whether they use ICT in teaching;
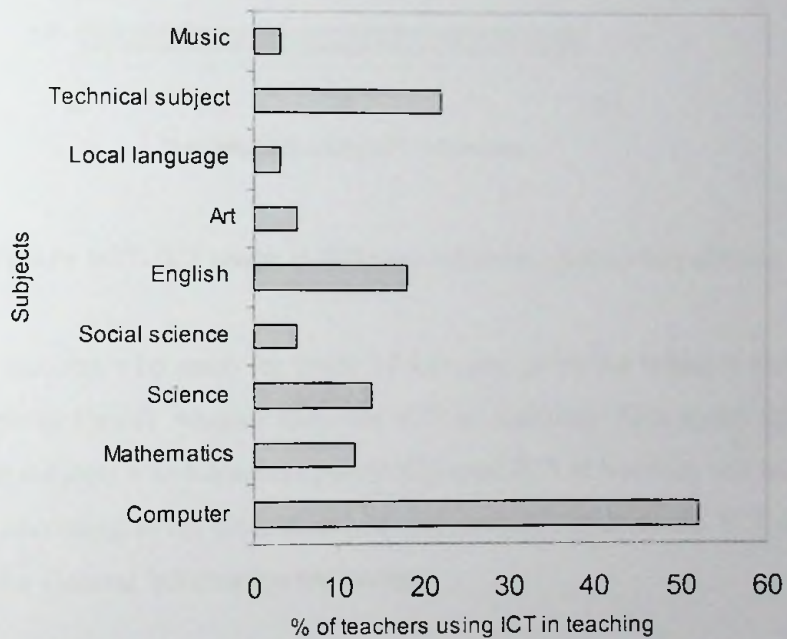
Figure 4-26: ICT usage in different subjects – junior secondary classes

According to the Figure 4-26 most of the teachers use ICT in the computer subject. For the grade 10-11 ICT is offered as an optional technical subject. The ICT use for other subjects like Mathematics, Science, English and Arts are not that significant. Most of the schools still use ICT as a separate subject and not integrated to teach other subjects.
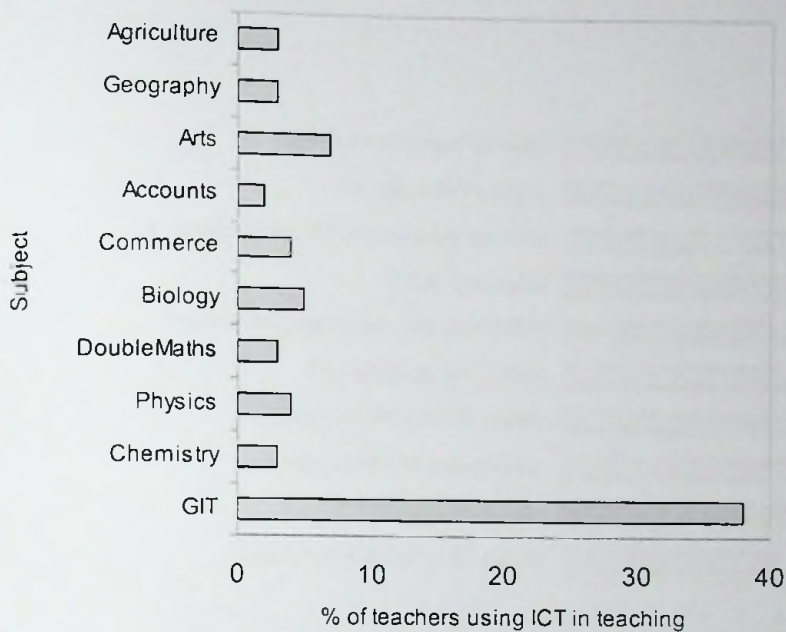
Figure 4-27: ICT usage in different subjects – Secondary classes

For the teachers who teach for grade 12-13 were given the subjects shown in the graph to specify whether they use ICT in teaching. This looks only the common subjects which teachers potentially used ICT in learning and teaching process according to the discussion had with several stakeholders. ICT is used mainly for General Information technology.

Variation in computer usage for different purposes

Teacher's use of ICT for different kind of purposes and variation in computer usage for different purposes were examined. Answers to these questions were given on 5 point scale from every day (=5) to not at all (=1). This looked at how teachers have used ICT specially computers in various purposes; how frequent they make use of SchoolNet to communicate with students and other teachers; how frequent they use SchoolNet to obtain learning material; how frequent they use computers for teaching computer skills; how frequent they use computers as a teaching tool for teaching other subjects; how frequent they

63

use computers for doing administrative task like preparing students record books.

Personal development (Self study)
Preparing student's reports
Communicat with other teachers (through schoolNet)
Accessing schoolNet
Communicating with students (through schoolNet)
Preparing lessons/Lecture notes
Making presentations for the students
Finding information from schoolNet
Teaching computer skills
Teaching and learning for specific subjects

0 0.5 1 1.5 2 2.5 3 3.5 4 4.5 5

Frequency of Access (1=Not at All, 5=Every Day)

Figure 4-28 : Variation in computer usage in different purpose

Computer Access

According to the figure 4-29, majority of teachers have access to computers at school's computer learning center and around 41% have access to computers at home as well.
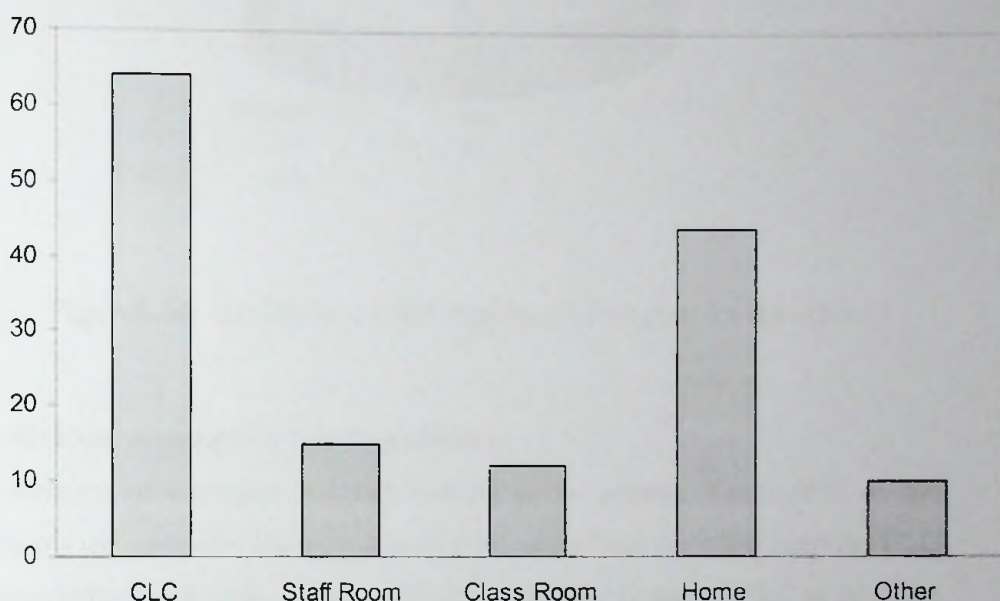
Figure 4-29: Teachers access to ICT at different locations

All the teachers who took part in the survey have access to computers at least at one place. This availability of computer access might cause their high ICT skill level.

4.5.4 Strategic use of ICT in schools

According to the answers given by principals, 82% of the schools have ICT implementation plans for their schools and they integrate ICT into learning and teaching process according to the plan.
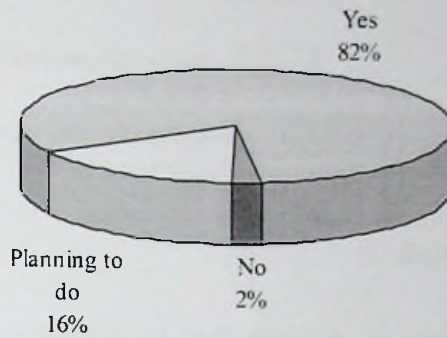
Figure4-30: Availability of ICT implementation plan for the school

Utilization of computer learning centers

Utilization of computer learning centers is as follows. Only 55% of the schools use computer learning centers after school and very few keep the CLC open during week ends. Around 30% of schools make use of CLC to generate revenue for their maintenance.
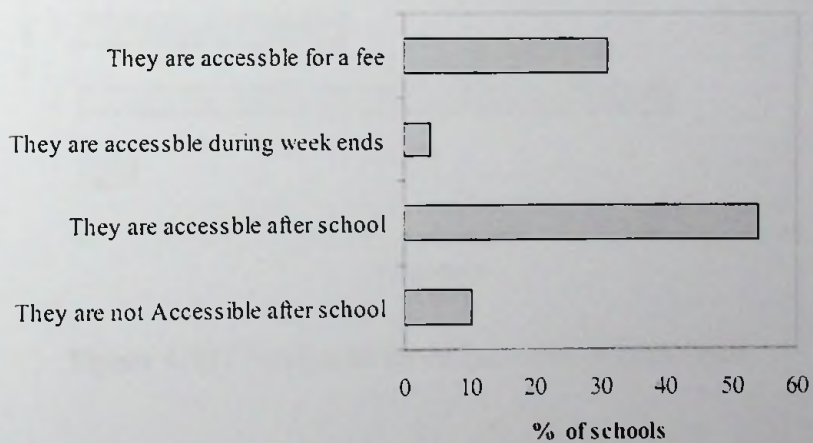
Figure 4-31: Availability of CLC after school – for students and teachers

Availability of CLC for parent and other community members are not significant. However around 30% of school make use of CLC for revenue generation.
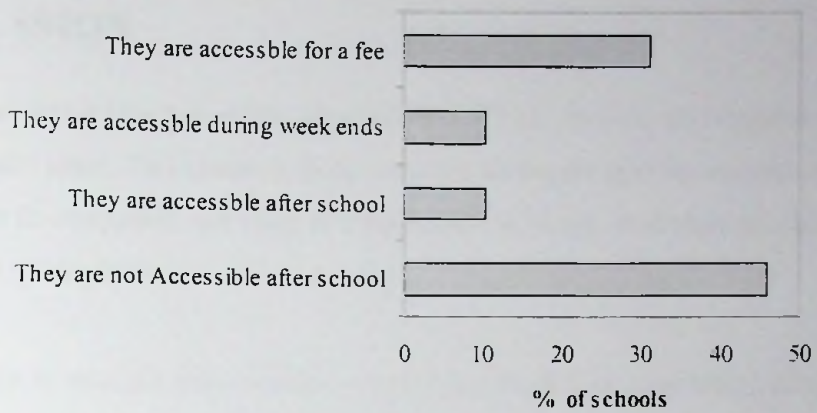
Figure 4-32 : Availability of CLC after school – for parents and other community members

More than 40% of schools have conducted at least two sessions to make parent and community aware about the benefits of ICT. Some schools have conducted around five sessions.. This represents the principal's enthusiasm and competency in integrating ICT into learning and teaching process.
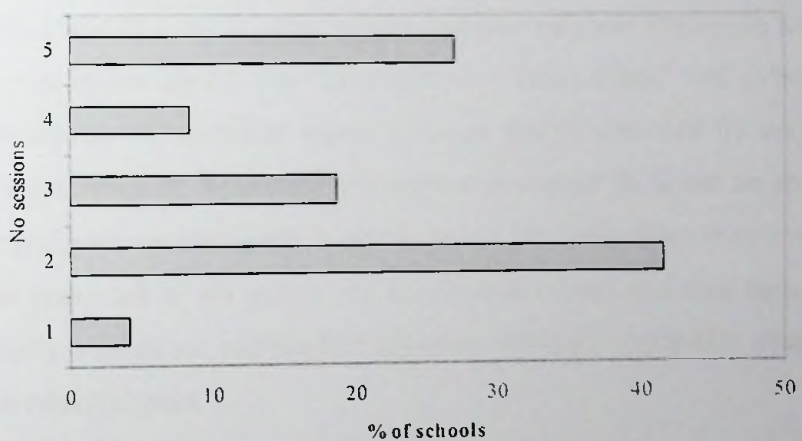
Figure 4-33 : Number of awareness sessions conducted

5. DISCUSSION

Digital divide (the gap in the adoption of ICT) has become an important topic in recent years. This research study provides an insight into the current level of access to computers and other ICT resources, at home, at school, at classroom and at other places.

Sample is selected from schools which were funded by Secondary Education Modernization Project (SEMP) and almost all the schools were provided with fully equipped computer learning centers (CLC).Therefore all the respondents meant to have computer access.

Access to computers at home is relatively less than access at school. The tendency for more students access computers at school than home more common in countries like Sri Lanka with comparatively low level of access to computers at home. Additionally, students access computers at homes of relatives, friend or even at public places such as computer centers in temples, community access centers like "Nanasala" or "Tele-centers" and cyber cafe. The availability of computer access at those places does not lie under the scope of the research. According to Figure 4-3 of page 32, it can be seen that the computer access among the sample is equal. However, from the correlation analysis presented in the section 4.1.6, it can be stated that that there is no statistically significant relationship between student's computer usage and their perceived impact.

However, some of the past research studies have been found that the existence of relationship between the amount of ICT use by the students and their attainment level of ICT. "Test Bed" project and "PILOT project – Norway" are some examples. However, "ImpaCT2" study concluded that there is no direct relationship between the average amount of ICT use for any subject at a given key stage and the effectiveness in raising standards. What all maters is the type of use of ICT in schools not the amount of use. This study also shows that even though students perceived an impact of ICT on learning, the length

68

of the time they use ICT and the availability of computer access did not alter their view

Since computer is relatively a new and hot topic in schools, all the students perceived an impact of it on their education regardless of their usage. The numbers of hours they are using computer at school mainly depend on the number of hours allocated to each class to carry out their classes at the computer learning center. This is due to resource limitations in the school and the limited time available for students due to their busy schedules with the competitive exams. Students perceived an impact of computers on their learning regardless of time spent on using computers. The studies which have shown that there is a positive relationship between the amount of ICT use and impact on students learning, students had use computers for quite sometime and they actually experienced the impact. But in this study students are in the early stages of adoption. If the study measured the actual impact or the student's attainment level then the results would have been different to this.

However it should be emphasized that the numbers of lessons teachers make use ICT as a teaching tool (excluding GIT and optional technical subject in O/L) was generally low over the period concerned (Figure 4-26 of page 63 and Figure 4-27 of page 64). This is likely to improve as teachers gain in knowledge from competency building programs and personal experience, as more and more ICT resources are made available in schools and as there are improvements in the variety of learning materials, both on the SchoolNet and on CDROM.

The study also found that students with high level of ICT skills (Section 4.1.4) and positive attitudes toward use of ICT (Section 4.1.3) have perception that ICT can impact on their learning. From the Figure 4-7 of page 35, it can be seen that vast majority of students are pretty much confident in performing basic ICT tasks as well as basic computer applications like word processing and spreadsheet, both of which have educational potential. Students are generally confident about their skills in using presentation technologies and skills in using communication technologies. Furthermore fewer students are

confident in performing high level tasks, such as constructing a simple web page, writing a computer program and retrieving data from a database. More than 50% of the students are generally competent in accessing internet and sending email both which fulfill the 21st century skills.

The ICT skill levels of the teachers are shown in the Figure 4-14 of page 43 and the results of the correlation analysis of relationship between ICT skills and there perceived impact of ICT on learning and teaching is tabulated in the Table 4-7 of page 45. From those results it cab be stated that there is no direct relationship between the ICT capabilities of teachers and their perceived impact.

Ministry of education is having a strong focus on competency development for teachers and principals regarding the use of ICT for learning and teaching purposes. According to the correlation analysis of the relationship between ICT training provided for the teachers and their attitudes towards use of ICT in teaching (Table 4-8 of page 46), it can be seen that that impact of this investment are not that strong.

The study results presented in section 4.2.2 shows that 95% of teachers have participated in competency development regarding ICT. About 76% teachers in this study assess that they have the necessary competency to integrate ICT in their teaching. However, only 56% of the teachers agree that it is highly relevant to use ICT to support the academic content of their teaching. Not only does their competency influence their ability and willingness to use ICT for teaching and learning purposes, but also teachers' ability to see the relevance of doing so influences their use. Training sessions are conducted with the aim of integrating ICT into learning and teaching process. Therefore the gap between the ICT competency gained from training and their perception on relevancy of use of ICT for leaning and teaching process needs to be investigated in more detail in future studies.

Study revealed that schools are not utilizing the ICT resources to their maximum. Figure 4-20 of page 58 shows that there is a gap between the

availability of ICT resources in the schools and accessibility of the ICT resources for students use. According to the study results presented in section 4.5.4, only 82% schools have ICT implementation planed. 16% have planning to lay down plans. 2% of schools have been investing money on ICT with out having proper planning (Figure 4-30 of page 67). CLCs are under utilized too. Only 55% (Figure 4-31 of page 67) of them are available for teachers and students to use after school hours and utilization of CLC during weekends is as little as 10% (Figure 4-32 of page 68).

Presently ICT implementation at schools has been driven by a few committed enthusiasts among teachers. In many schools ICT is not strategic but something that enthusiasts and Ministry of education is taken care of the implementation. It has not been introduced across the school but in isolated places. As a result, ICT is not seen as a general strategy at school level and teachers are using ICT arbitrary. This results less help from other teachers to develop learning contents and less collaboration between teachers.

6. RECOMMENDATIONS AND CONCLUSIONS

6.1 Recommendations

The discussion and the analysis lead to the following recommendations. Further it addresses the barriers identified in section 4.4 for achieving greater impact of ICT in schools.

Competence development must be followed up by clear objectives

Results of this study (analysis of hypothesis 6) and other studies show that poor results of ICT training. According to principals, insufficient professional development for teachers and lack of ICT competencies were among the most significant barriers. This could be improved by following more strategic and systematic approach.

- Inclusion of ICT in all subjects and follow-up on the use of ICT at school level.
- More focus should be given to integrate ICT into teaching process in the initial teacher training (during pre-service).
- The factors which prevent teachers from using the knowledge they gained from ICT training programs need to be identified and follow-up at school level.

Teachers who were already trained can be used to teach other teachers in the school. These will speedup the teacher training programs within the school. It will be more efficient and less expensive as training is localized to the school. The study results also show that competency building programs for teachers foster positive attitudes towards the use of ICT. Giving training for all the teachers creates a good teamwork environment in schools which helps to integrate ICT into learning and teaching process more easily.

Many of the principals and teachers have reported that non functional ICT equipment in the school and inefficiencies obtaining technical support as the

most significant barrier. And they also believe that lack of computer hardware knowledge preventing them from better utilizing ICT resources and efficient use of ICT. By including hardware training module in the professional training program would help to address this deficit in hardware knowledge.

Optimal use of ICT requires strategic implementation

If the full potential of ICT in schools is to be further realized. principals of the schools need to be more professional in their implementation and strategic thinking needed in throughout the implementation. Under utilization of ICT resources can be kept very low by having a mechanism for structured monitoring and evaluation of benefits of ICT implementation.

Return on investment from ICT investment requires commitment from both school management and parents. They must be visionary enough to initiate and continually support the use of ICT as a strategic tool for achieving general goals of school. A clear vision of use of ICT in schools should be communicated to all level of the staff and the wider school community. The setting up of clear objectives for the use of ICT is a responsibility of the school heads. School heads could use more and more awareness programs to energize the school community as well and their parents with regard to successful usage of ICT and potential benefits of ICT in education. The author believes that the responsibility of successful implementation ICT is a responsibility of school heads and cannot delegate to committed enthusiasts among teachers. Since unsuccessful implementation of ICT is very costly and time consuming, strategic leadership in ICT has become a core competency of school authority

Integrate the ICT strategy into the school's overall strategy

The successful school heads need to understand that ICT implementation should be integrated into the core strategic development of the school and cannot be isolated. Specific strategies for integrating ICT into learning and teaching should be laid down and they must go hand in hand with other strategies at the school and they should make common and widely known among the teachers and students. In order to get the full benefit from the ICT

investments, it is quite obvious that ICT implementation should included great amount of change management .The whole school community should be taken part of the ICT implementation to get maximum support and in order to minimize the resistance. In this way ICT has the greatest potential to act as a catalyst for educational innovation rather than an additional resource of the school.

Use of existing resources

Research has identified that as English being the dominant language of the Internet, it is a serious barrier to maximizing the educational benefits of the World Wide Web. The research also found that most of the teachers have basic ICT knowledge and as well the knowledge in pedagogical use of ICT. They can be used to develop learning contents in local language for the SchoolNet. Since they are involved in teaching using ICT they may have better understanding about what sort of learning material are helpful and what are the issues in the current learning material.

Even by holding a contest for developing creative and innovative learning materials could be help to solve the problem with insufficient learning material in the SchoolNet. Students can get involved in developing learning material and best products can be rewarded. The annual software competition in schools might be the ideal place for this.

Continuous assessment and school based assessment can be put in the SchoolNet and teachers can encourage students to take assignments online. For this to happen, we must ensure that schools have at least 1:2 computer to student ratio. For schools with very few computers where student computer ratio is around 1:5 recommended ways is to develop group based assignment.

For teachers web forums and internet chat can be promoted to do communication and they can exchange their information through the SchoolNet. The general forums for any subject would create teachers to work more collaboratively and it promotes group thinking among teachers.

Motivate teachers to use ICT

In addition to have proper ICT infrastructure learning content and required skills, teachers motivation is a curtail factor in successful ICT adoption. As the survey has shown, students' and teachers' motivation to use ICT are among the most significant driving forces of successful usage of ICT in schools. Providing teachers with their own personal computer will definitely motivates them and helps to increase their confidence. Polices should include actions to encourage teachers to use ICT. Policies should also incentives and recognitions and rewards for effective use of ICT.

Capitalize on positive attitudes

As research as shown both students and teachers both have positive attitudes regarding the use of ICT. Schools should capitalize on positive attitudes. However government intervention and training programs have not contributed to their positive attitudes. There seems to be a mismatch between the potential of training programs and teachers attitudes towards use of ICT in teaching. Majority of teachers think that ICT they can improve teaching by making use of ICT resources. ICT training programs can be used to make teachers more positive about the use of ICT. This could be achieved by providing easy to use ICT based materials, ICT learning materials in local language and more hands on practical sessions.

6.2 Conclusions

From this study it can be concluded the following.

- The reported usage of ICT by students has no impact on their learning.
- Both students and teachers with positive attitudes towards use of ICT believe that ICT has an impact on learning and teaching.
- Students with good ICT skill levels have positive attitudes towards the use of ICT and ICT skill level of principals have perceived an impact of ICT on students learning.
- Government interventions and training programs not results in a positive attitude towards the use of ICT in teaching and the ICT training given to teachers don't have a relationship to their perceived impact of ICT on learning and teaching.
- Mere presence of ICT resources in schools does not contribute to students learning.

Future studies in impact of ICT on learning and teaching should include actual measurement of students' achievement due to technology integration, and further factors influencing successful ICT integration in schools.

7. REFERENCES

[1] United Nations, "UN Millennium development goals," *The UN Millennium Development Goals*, 2006.
[Online]. Available: http://www.un.org/millenniumgoals/. [Accessed: July 25, 2007].

[2] United Nations, "Information technology must be used to promote development, Annan tells UN forum," *UN News Centre*, 2005. [Online]. Available: http://www.un.org/apps/news/story.asp?NewsID=13961&Cr=information&Cr1=techn ology. [Accessed: July 5, 2007].

[3] C. P. Newhouse, "Literature Review the impact of ICT on learning and teaching," 2002. [Online]. Available: http://www.dct.wa.edu.au/education/cmis/eval/pd/reading/reading1.htm. [Accessed: Feb. 16, 2007].

[4] Sri Lanka. Central Bank of Sri Lanka. *Annual report 2006*. Colombo: Central Bank of Sri Lanka, 2006.

[5] Department of Census and Statistics, "Census on Computer Literacy of Academic Staff of Government Schools, Approved Private Schools and Pirivenas 2006," *Department of Census and Statistics*, 2006. [Online]. Available: http://www.statistics.gov.lk. [Accessed:Jan. 25, 2008].

[6] Sri Lanka. Ministry of Education. *Annual School Census Reports 2006*. Colombo: Ministry of Education, 2006

[7] G.M.N Gunadasa, "ICT in Education Policies in Sri Lanka: Challenges and Opportunities," presented at e-Global Leaders Conference 2007, Seoul, Korea, Sept, 2007.

[8] D. Withanage, "Government policies and strategies on information and communication technology (ICT) for rural poverty reduction in Asia and the Pacific region," presented at Expert Group Meeting, Bangkok, Thailand, Nov. 2003.

[9] Asia-Pacific Development Information Programme, "ICT Profile - Sri Lanka," *Asia-Pacific Development Information Programme* , 2006. [Online]. Available: http://www.apdip.net/projects/dig-rev/info/lk. [Accessed: Feb. 16, 2007].

[10] N. Gunatilleke, "UNDP volunteers to work in Sri Lanka development programs," *Daily News*, June 25, 2004. [Online]. Available: http://www.dailynews.lk/2004/06/25/index.html. [Accessed Feb. 13, 2007].

[11] Ministry of Education, "Secondary Education Modernization Project II," *Ministry of Education, 2007*. [Online]. Available: http://www.moe.gov.lk/semp/aboutSEMP2.php. [Accessed: Feb. 20, 2007].

[12] International Federation for Information Processing, "Sri Lanka Country Report:History of ICT Policy Formulation," *International Federation for Information Processing, 2007.*
[Online]. Available: www.ifip.or.at/minutes/GA2005/Rep_SriLanka1.pdf.
[Accessed: Jan. 20, 2008].

[13] South East Asia Regional Computer Confederation, "SEARCC 2005 Round Table Report Sri Lanka," *South East Asia Regional Computer Confederation.* 2005.
[Online]. Available: www.searcc.org/round_table/SEARCC2005RT.ppt.
[Accessed: Jan. 24, 2008].

[14] Information and Communication Technology Agency, "Rising Demand." *Information and Communication Technology Agency.* 2007. [Online]. Available: www.icta.lk/Insidepages/downloadDocs/ICTWorkforcSurvey2007.pdf.
[Accessed: Jan. 24, 2008].

[15] Asia-Pacific Development Information Programme, "An Overview of ICT Policies and e-Strategies of Selected Asian Economies," *Asia-Pacific Development Information Programme* , 2004. [Online]. Available: http://www.apdip.net/publications/ict4d/ict4dlallana.pdf. [Accessed: Feb. 16, 2007].

[16] T.D.S.S Silva, "A research study on usage of computers at school computer learning centers as a learning and teaching tool," M Phil thesis. Open university of Sri Lanka, Nawala , Sri Lanka , 2007.

[17] Oraganization for Economic Co-operation and Developement. "Are Students Ready for a Technology-Rich World?: What PISA Studies Tell Us," *Organization for Economic Co-operation and Development. 2004.* [Online]. Available: http://www.oecd.org/dataoecd/28/4/35995145.pdf.
[Accessed: May 6, 2007].

[18] J. Ravitz, J. Mergendoller, and W. Rush, "What's school got to do with It? : Cautionary tales about correlations between student computer use and academic achievement," presented at Annual meeting of the American Educational Research Association, New Orleans, LA, April. 2002.

[19] British Educational Communications and Technology Agency, "Impact2: The Impact of Information and Communication Technologies on Pupil Learning and Attainment," British *Educational Communications and Technology Agency.* [Online]. Available:
http://www.becta.org.uk/page_documents/research/ImpaCT2_strand1_report.pdf.
[Accessed: Feb. 16, 2007].

[20] European Commission, Education in eEurope-innovative practices in schools", *European SchoolNet.* Dec. 11, 2006. [Online]. Available: http://ec.europa.eu/education/doc/reports/doc/ictimpact.pdf
[Accessed: July 16, 2007].

[21] C. Nelson, "Effective and innovative use of IT developing positive learning attitudes,"presented at Institute of Technical Education teachers' conference.

Singapore, 2003. [Online]. Available:
http://edt.ite.edu.sg/ite_conf/edu_tech/tc03et01.pdf.
[Accessed: Mar 16, 2007].

[22] C. Higgins, et al., "Embedding ICT in the literacy and innumeracy strategies:
final report, "*British Educational Communications and Technology Agency*, April
2005. [Online].

[23] J. Underwood, et al., "ICT Test Bed evaluation-evaluation of the ICT Test Bed
project," *ICT Test Bed Evaluation*, March 2006. [Online]. Available:
http://www.evaluation.icttestbed.org.uk/about. [Accessed: Mar. 16, 2007].

[24] S. Machin, S. McNally, and O. Silva, "New Technology in Schools: Is There a
Payoff?," *Economic Journal*, vol. 117, no. 522, pp.1145-1167, July 2007. [Online].
Available: Blackwell Synergy, http://www.blackwell-synergy.com/.
[Accessed Aug 12, 2007].

[25] International Telecommunication Union, "Project Innovation in Learning,
Organisation and Technology," *International Telecommunication Union, "Project
Innovation in Learning*, 2004.
[Online]. Available: http://zalo.itu.no/ITU/filearchive/ENG_PILOT_FV.pdf.
[Accessed: May. 12, 2007].

[26] A. Daniel, et al. "Monitoring and evaluation of ICT in education projects. A
handbook for developing countries," *UNESCO Bangkok*, 2005. [Online]. Available:
http://www.unescobkk.org/index.php?id=3731.
[Accessed: June 20, 2007].

[27] K. Evgueni and P. Mariana, "Information and communication technologies in
teacher education: a planning guide," *UNESCO Documents and Publications*,
ED/HED/TED/3, 2002. [Online]. Available:
http://unesdoc.unesco.org/images/0012/001295/129533e.pdf.
[Accessed: Aug. 20, 2007].

[28] UNESCO Bangkok, "Training Teachers to Integrate ICT into Education,"
UNESCO Bangkok. [Online]. Available: http://www.unescobkk.org.
[Accessed: July 16, 2007].

[29] C. Creed, H. Perraton, and B.Robinson, "Teacher education through distance
learning, technology, curriculum cost evaluation," *UNESCO Documents and
Publications*, 2001. [Online]. Available:
http://unesdoc.unesco.org/images/0012/001242/124208e.pdf.
[Accessed: Aug. 20, 2007].

[30] Ramboll Management, 'Elearning Nordic 2006: Impact of ICT on Education',
Ramboll Management. [Online]. Available:
www.edu.fi/julkaisut/eLearning_Nordic_English.pdf. [Accessed: July 16, 2007].

[31] V. Ham, et al., "What makes for effective teacher professional development in
ICT?," *Education Counts*. [Online]. Available:

79

http://educationcounts.edcentre.govt.nz/publications/curriculum/what-makes.html.
[Accessed: July 16, 2007].

[32] The Office for Standards in Education. "ICT in Schools: effect of government
initiatives - implementation in primary schools and effect on literacy." *The Office for
Standards in Education*, June 2002.
[Online]. Available: http://www.ofsted.gov.uk/assets/2615.pdf. [Accessed: July
2007].

[33] K. D. Gunawardana, "An Empirical Study of potential challenges and Benefits of
Implementing E-learning in Sri Lanka," in *Proceedings of Second International
Conference on learning for Knowledge-Based Society*, 2005, pp. 33.1-33.8.

[34] SPSS Inc., *SPSS for windows Rel. 13.0.* [CD-ROM]. Chicago: SPSS Inc., 2004

APPENDIX 1: SURVEY QUESTIONNAIRE

Impact of ICT on Learning and Teaching

This survey is carried out to identify the impact of ICT on learning and teaching. The purpose of this survey is co collect data for my research project in the MBA (IT) program at the University of Moratuwa. I assure you that your responses will be kept strictly confident and will only be used in the data analysis in my research project.

This survey consists of three separate questionnaires.

Questionnaire 1	Survey Questionnaire for principals
Questionnaire 2	Survey Questionnaire for teachers
Questionnaire 3	Survey Questionnaire for students

For statistical validity, I would prefer if you respond to all the questions in this survey.

Instructions

To complete this survey, please read each question carefully and answer by ticking the appropriate box Or writing your answering the space provided

Ravina Panangalage

No 775 "Tulip",

Millennium City,

Oruwala,

Athurugiriya.

0777 - 741077

Questionnaire 1

ICT Survey Questionnaire for Principals

1. Name of the school:

2. Province /District:

3. Name of the Principal (Optional):

4. Gender ☐ Female ☐ Male

Section A - ICT infrastructure in the school

Equipment	Availa bility	Number of units	Equipment	Availa bility	Number of units
CLC center with furniture and AC	☐		Overhead projector	☐	
Computers - functioning	☐		Multimedia projector	☐	
Computers – non functioning	☐		TV	☐	
Multimedia accessories (Headset)	☐		VCD	☐	
Operating system software	☐		VHS	☐	
Application software	☐		DVD	☐	
UPS	☐		Radio cassettes	☐	
Network cabling for the computers and Network Switches	☐			☐	
SchoolNet facility	☐			☐	

5. Average number of computers available for 10 students (computer Student ratio)
    ☐ One ☐ Two ☐ Three ☐ Four ☐ Five

6. How many ICT trained teachers in the school?

7. How many CAL (Computer Assisted Learning) trained teachers in the school?

8. In average how many hours per week allocated to each class to conduct their lessons in the computer learning center?

Section B - Strategic use of ICT resources in the school

9. Do you have an ICT implementation plan for the school?
    ☐ Yes ☐ No ☐ planning to make one

10. Do your teachers and students have access to the computer learning center after school hours and during weekends?
  ☐ No, they are never accessible   ☐ they are sometimes accessible
  ☐ They are always accessible   ☐ they are accessible for a fee

11. Does your school allow parents and other community members to access CLC resources?
  ☐ No, they are never accessible   ☐ they are sometimes accessible
  ☐ They are always accessible   ☐ they are accessible for a fee

12. Number of sessions conducted during the last year to make students, teachers and community aware of the benefits of ICT for education, and day today work and to inform about the CLC's in the school.
  ☐ More than five ☐ Two to Five ☐ One ☐ Not at all ☐ Planning to do

13. Does the school have a register to record the how the ICT resources are utilized in the schools and to record the details of the teacher and the subject for which it is used whenever it is used?
  ☐ Yes ☐ No

14. To what extent would you think that monitoring ICT usage in school in result in better and efficient usage of ICT resources in the school
  ☐ Strongly agree ☐ Agree ☐ Don't know ☐ Disagree ☐ Strongly disagree

Section C - ICT Knowledge/Competency of principals

15. Did you attend any of the ICT training programs? ☐ Yes ☐ No

16. Type of the training
  ☐ E-Citizen training program?
  ☐ Any other. Please specify

17. How comfortable are you in using computes with the use of the following in relation to your day to day work?

	Excellent	Very Good	Good	Fair	Not Capable
Using and managing technology Operating computers	☐	☐	☐	☐	☐
Using basic computer applications Spread sheets, Word processing	☐	☐	☐	☐	☐
Using presentation software Power point presentations	☐	☐	☐	☐	☐
Using communication technologies Use of Email and internet	☐	☐	☐	☐	☐

Section D - Perceived Impact

To what extent would you agree with following Statements with regard to use of ICT in your school for teaching and learning?

	Strongly agree	Agree	Don't know	Disagree	Strongly disagree
18. ICT has influenced pupils learning.	☐	☐	☐	☐	☐
19. It has potential to influence pupil's basic skills like reading, Writing and calculation.	☐	☐	☐	☐	☐
20. It has influenced pupil's performance	☐	☐	☐	☐	☐
21. It has increased the pupil's motivation to learn	☐	☐	☐	☐	☐
The availability of ICT infrastructure in school has made an impact on students learning	☐	☐	☐	☐	☐
22. ICT is not used as a strong catalysts for education innovations, rather it used as an additional resource	☐	☐	☐	☐	☐
The use of ICT create positive attitudes towards leaning of students	☐	☐	☐	☐	☐
23. Use of ICT in schools for learning helps students to improve knowledge and teachers to teach efficient and	☐	☐	☐	☐	☐

Section E - Barriers and drivers for successful usage of ICT for teaching and learning

24. Please rank the most significant 5 driving forces in you school, and if you have any others please specify them in the bank rows at the end of the table

No	Drivers	Rank
1	ICT is central to curriculum development in the whole-school improvement plan	
2	Current education policies at school encourages teachers/students to use ICT in the school	
3	Current school culture does support to use of ICT in teaching and learning	
4	Teachers believe that ICT can use as a teaching tool	
5	Easily accessible ICT equipment and infrastructure	
6	Good maintenance and technical support	
7	Availability of sufficient, good selection of interesting learning software	
8	The learning contends is in the local language and it promotes better use of ICT	
9	Provision of appropriate, sustained ICT professional development for all levels of Staff	
10	Teachers have good understanding about why they should use ICTs how	

	exactly they can use ICTs to help them teach better	
11	Teachers have good basic ICT skills and other skills with particular computer applications	
12	Pupils motivation for using ICT	
13	Teachers motivation for using ICT in teaching	
14	Good collaboration and support from teachers	
15		
16		

25. Please rank the most significant 5 barriers in you school, and if you have any other please specify them in the bank rows at the end of the table.

No	Barriers	Rank
1	Current education policies at school does not encourage teachers/students to use ICT in the school	
2	Current School culture does not support to use of ICT in teaching and learning	
3	Teachers does not perceive ICT as a tool to meet curricular goals	
4	Unavailability/inaccessible ICT equipment	
5	Non functional ICT equipment in the school and inefficiencies in maintain and obtaining technical support	
6	English is the dominant language of the Internet. It is serious barrier to maximizing the educational benefits of the World Wide Web	
7	The learning contends not in the local language to promote better use of ICT	
8	Lack of learning materials in the SchoolNet	
9	Insufficient ICT professional development for all levels of Staff	
10	Teacher's lack of understating on why they should use ICTs in teaching	
11	Lack of understanding of how they can use ICTs to help them teach better	
12	Lack of basic ICT skills among teachers	
13	Lack of skills with particular computer applications (e.g.-PowerPoint/ word processing)	
14	Lack of financial support for purchasing ICT equipments	
15	Heavy cost for maintaining and obtaining technical support	
17		
18		

Questionnaire 2

ICT Survey Questionnaire for Teachers

1. Name of staff (optional):

2. Name of School:

3. Gender ☐ Female ☐ Male

4. Age in years:

5. Number of years in the service (in years) :

6. Highest degree earned ☐ Undergraduate degree ☐ Training ☐ National diploma in teaching

7. Academic levels taught
   ☐ 10- 11 ☐ 12 – 13 ☐ Both

Section A - Professional development

8. Did you receive any training in information and communication technology (ICT)?
   ☐ During Pre-service ☐ While in-service during the past 3-years ☐ No Training

9. If you have participated in any ICT training session, please indicate the type /nature of the training program.

   ☐ Basic use of ICT ☐ Pedagogical use of ICT
   ☐ Advanced use of IT ☐ Developing electronic learning materials

Section B - Teachers Skills and experience

10. How many years have you been using computers?

11. Please rate your skills in the use of the following:

	Excellent	Very Good	Good	Fair	Not Capable
Using and managing technology					
Starting and shutting down of Pc	☐	☐	☐	☐	☐
Use of key board and mouse	☐	☐	☐	☐	☐
Managing computer files and folders	☐	☐	☐	☐	☐
operating printers	☐	☐	☐	☐	☐
using the computer network	☐				
Using basic computer applications					
word processing	☐	☐	☐	☐	☐
Spreadsheets	☐	☐	☐	☐	☐
Graphics	☐	☐	☐		
Using presentation software					

developing a presentation	☐	☐	☐	☐	☐
delivering a presentation	☐	☐	☐	☐	☐
interactive multimedia programs	☐	☐	☐	☐	☐
Using communication technologies					
Use of E-mail	☐	☐	☐	☐	☐
Read and attached email attachments	☐	☐	☐	☐	☐
Internet browsing	☐	☐	☐	☐	☐
Internet chat	☐	☐	☐	☐	☐
Video conferencing	☐	☐	☐	☐	☐
Advance concepts					
Web page designing	☐	☐	☐	☐	☐
Programming	☐	☐	☐	☐	☐
Database management	☐	☐	☐	☐	☐
Pedagogical related skills					
Computer assisted learning techniques (CAL)	☐	☐	☐	☐	☐
Developing curriculum related electronic Contents	☐	☐	☐	☐	☐

Section C - Teachers use of ICT

12. In which subjects do you use ICT as teaching tool?(Check all that apply)

Subject	Use of ICT	Subject	Use of ICT
Computer class	☐	GIT (A/L)	☐
Mathematics	☐	Chemistry	☐
Science	☐	Physics	☐
Social sciences	☐	Mathematics	☐
English	☐	Biology	☐
Art	☐	Commerce	☐
Local language	☐	Accounts	☐
technical subject	☐	Arts	☐
Music	☐	Geography	☐
	☐	Agriculture	☐

13. How often do you use ICT tools in the following purposes?

	Every Day	Once a week	Few times a month	Once in several months	Not at all
Teaching-learning for specific subjects	☐	☐	☐	☐	☐
Teaching computer skills	☐	☐	☐	☐	☐
Finding/accessing information and educational materials from the schoolNet	☐	☐	☐	☐	☐
Making presentations for the students	☐	☐	☐	☐	☐

Preparing lessons/Lecture notes	☐	☐	☐	☐	☐
Communicating with students through schoolNet	☐	☐	☐	☐	☐
Accessing to schoolNet	☐	☐	☐	☐	☐
Communicating with other teachers through schoolNet	☐	☐	☐	☐	☐
Preparing student's reports	☐	☐	☐	☐	☐
Personal development	☐	☐	☐	☐	☐

14. Do you have your own Personnel computer
☐ Yes ☐ No ☐ Planning to buy under teacher PC drive programme

15. Do you have an internet connection at home?
☐ Yes ☐ No

16. Where do you use computers? And how many hours per week are computers accessible to you?

		Hours/Week
a.	At computer learning center (CLC)	
b	At staff room	
c.	At classroom	
d.	At home	
e.	At other places	

Section D - Teachers perception

Please indicate to what extent you would agree with following Statements with regard to use of ICT in your school for teaching and learning

	Strongly agree	Agree	Don't know	disagree	Strongly disagree
17. ICT has influenced pupils learning outcomes	☐	☐	☐	☐	☐
18. It has potential to influence pupil's basic skills like reading, writing and calculation due to its ability to present things visually.	☐	☐	☐	☐	☐
19. It has influenced pupil's performance	☐	☐	☐	☐	☐
20. It has increased the pupil's motivation to learn	☐	☐	☐	☐	☐
21. The availability of ICT infrastructure in school has made an impact on students learning?	☐	☐	☐	☐	☐
22. The use of ICT create positive attitudes towards leaning by students	☐	☐	☐	☐	☐
23. Use of ICT in schools for learning and teaching wastes time. Because it take lot of time to prepare notes and get used to the technology	☐	☐	☐	☐	☐

24. Providing ICT Training for teachers helps them to improve their ICT skills and competency	☐	☐	☐	☐	☐
25. Providing a computer for personal use help to improve the ICT skills and improve your confidence in use of ICT for teaching.					
26. To what extent do you find it relevant to use ICT to support the academic content of your teaching?	☐	☐	☐	☐	☐
27. To what extent do you estimate that the use of ICT actually has contributed to better teaching process					
28. Use of ICT in schools for teaching helps teachers to teach efficiently and effectively	☐	☐	☐	☐	☐

Barrier and drivers for successful usage of ICT for teaching and learning

29. Please rank the most significant 5 driving forces in you school and if you have any other please specify them in the bank rows at the end of the table

No	Drivers	Rank
1	A clear vision of use of ICT in school is communicated to all levels of staff and the Wider school community	
2	Clear objectives for use of ICT at the school is being set by the school heads and the responsible authorities	
3	Current education policies at school encourages teachers/students to use ICT in the school	
4	Easily accessible ICT equipment	
5	Availability of sufficient, good selection of interesting learning software	
6	Provision of appropriate, sustained ICT professional development for all levels of Staff	
7	Teacher's proper of understating of why they should use ICTs and how exactly they can use ICTs to help them teach better	
8	Pupils motivation for using ICT	
9	Good collaboration and support from teachers	

30. Please rank the most significant 5 barriers in you school and if you have any other please specify them in the bank rows at the end of the table

No	Barrier	Rank
1	A clear vision of use of CT in school is not communicated to all levels of staff and the Wider school community	
2	Clear objectives for use of ICT at the school is being not set by the school heads and the responsible authorities	
3	Current education policies at school does not help teachers/students to use ICT in the school	
4	Current School culture does not supports for use of ICT in teaching and learning	
5	Non functional ICT equipment and inefficiencies in maintain and obtaining technical support	
6	Lack of learning materials in the SchoolNet	
7	Unavailability of sufficient electronic learning materials	
8	English is the dominant language of the Internet. It is serious barrier to maximizing the educational benefits of the World Wide Web	
9	The learning contends not in the local language to promote better use of ICT	
10	Lack of appropriate, sustained ICT professional development for all levels of Staff	
11	Teacher's lack of understating of why they should use ICT in teaching	
12	Lack of understanding of how they can use ICTs to help them teach better	
13	Lack of basic ICT skills among teachers	
14	Lack of skills with particular computer applications (eg-PowerPoint, word processing)	
15	ICT was not introduced across the curriculum, therefore difficult to get support from other staff members.	
16	Heavy cost for maintaining and obtaining technical support	

Questionnaire No – 3

ICT Survey Questionnaire for Students

1. Name

2. Gender ☐ Female   ☐ Male

3. Age

4. Grade

5. Name of the School

SECTION A – COMPUTER ACCESS AND USAGE

6. Do you have access to computers at any of these places?

		Yes	No
a.	At computer learning center (CLC)	☐	☐
b.	At classroom	☐	☐
c.	At home	☐	☐
d.	At other places	☐	☐

7. Have you ever used a computer? ☐ Yes ☐ No

8. How often do you use computers at these places? (Please tick one box in each row)

		Every Day	Once a week	Few times a month	Once in several months	Not at all
a.	At computer learning center (CLC)	☐	☐	☐	☐	☐
b.	At classroom	☐	☐	☐	☐	☐
c.	At home	☐	☐	☐	☐	☐
d.	At other places	☐	☐	☐	☐	☐

9. Please indicate whether you are that these ICT equipments are available in the school and have/have no access and using/not using the following in your schoolwork

No		Available in the school		Use them in class lessons	
		Yes	No	Yes	No
1	Computers – desk top	☐	☐	☐	☐
2	Lap top computer	☐	☐	☐	☐
3	Overhead projector	☐	☐	☐	☐
4	Multimedia projector	☐	☐	☐	☐
5	TV	☐	☐	☐	☐

6	VCD	☐	☐	☐	☐
7	VHS	☐	☐	☐	☐
8	DVD	☐	☐	☐	☐
9	Radio/cassette player	☐	☐	☐	☐
10	Computer printer	☐	☐	☐	☐
11	Headset	☐	☐	☐	☐

10. How many hours on the average **per week of normal school hours** are you able to use these computers and related ICT to do your school work

11. Do you have your own email address? ☐ Yes ☐ No

12. How many hours on the average per week of normal school hours you are using your email to check and send emails?

13. Do you have access to Internet (SchoolNet)? ☐ Yes ☐ No

14. If yes, how many hours on the average per week of normal school hours you are using Internet?

15. In which classes or subjects do you use computers and related ICTs?

O/L		A/L	
Subject	Use of ICT	Subject	Use of ICT
Computer class	☐	GIT (A/L)	☐
Mathematics	☐	Chemistry	☐
Science	☐	Physics	☐
Social sciences	☐	Mathematics	☐
English	☐	Biology	☐
Art	☐	Commerce	☐
Local language	☐	Accounts	☐
technical subject at O/L	☐	Arts	☐
Music	☐	Geography	☐
Music Western	☐	Agriculture	☐

16. For what purpose you are using ICT in the school.

Purpose	Every day	Once a week	Few times a month	Once in several months	Not at all
Informative: To find and acquire information (eg - from the school net or CD's)	☐	☐	☐	☐	☐
Functional To use existing information for doing school work / Assignment , use of learning material	☐	☐	☐	☐	☐
Creating To compose, compile, produce new information. Write papers , documents create presentation	☐	☐	☐	☐	☐

Communication to exchange and to transmit information with other students – Email / Web/ School net	☐	☐	☐	☐	☐

SECTION B – ICT Experience, skills and Competency

17. Do you have any prior knowledge of using computers? If yes, how did you obtain the knowledge?

☐	I have taught myself	☐	My family
☐	My teachers	☐	Other students
☐	My friends	☐	Training outside the schools

18. How many years have you been using computers

19. What sort of the things you have used computers

☐	Computer games	☐	Spread sheets for calculation
☐	Design web pages	☐	Word processing for documentation

20. How comfortable are you in using computes for following tasks

	Excellent	Very Good	Good	Fair	No Capability
Using and managing technology					
Starting and shutting down of Pc	☐	☐	☐	☐	☐
Use of key board and mouse	☐	☐	☐	☐	☐
Create/ edit documents	☐	☐	☐	☐	☐
Save a document	☐	☐	☐	☐	☐
Print a document	☐	☐	☐	☐	☐
Create folders	☐	☐	☐	☐	☐
Move files from one place to another	☐	☐	☐	☐	☐
Delete files and folders	☐	☐	☐	☐	☐
Using basic computer applications					
Create a word document	☐	☐	☐	☐	☐
Type a letter using word	☐	☐	☐	☐	☐
Use spreadsheets to do small calculations	☐	☐	☐	☐	☐
Use spreadsheets to plot a graph	☐	☐	☐	☐	☐
Using presentation software					
Create a power point presentation	☐	☐	☐	☐	☐
Create a multimedia presentation (with sounds pictures and video)	☐	☐	☐	☐	☐
interactive multimedia programs	☐	☐	☐	☐	☐
Using communication technologies					
Write and send emails	☐	☐	☐	☐	☐
Get on to internet	☐	☐	☐	☐	☐
Download files from internet	☐	☐	☐	☐	☐
Advance concepts					
Construct a simple web page	☐	☐	☐	☐	☐
Create a computer program	☐	☐	☐	☐	☐
Use data bases to retrieve information	☐	☐	☐	☐	☐

21. Thinking about the experienced you have with use of computers to what extend do you agree with the following statement.

	Strongly agree	Agree	Don't know	Disagree	Strongly disagree
It is very important to me to work with a computer	☐	☐	☐	☐	☐
Playing or working with a computer is really fun.	☐	☐	☐	☐	☐
I use a computer because I am very interested	☐	☐	☐	☐	☐
I can manage time well, when I am working with the computer	☐	☐	☐	☐	☐

SECTION C – Perceived Impact

22. To what extent you agree to the following statement.

	Strongly agree	Agree	Don't know	Disagree	Strongly disagree
You gain more knowledge when computers are used in learning subjects than they teach with out making use of computers?	☐	☐	☐	☐	☐
Do you think that ICT has potential to improve your basic skills like reading, writing and calculations?	☐	☐	☐	☐	☐
Do you feel that the you take more time to do work when computers are used in learning	☐	☐	☐	☐	☐
Has use of ICT Increased your enthusiasm for learning	☐	☐	☐	☐	☐
The availability of ICT infrastructure (CLC) in your school has made an impact on your learning	☐	☐	☐	☐	☐