ADEQUACY AND SUSTAINABILITY OF SECONDARY SCHOOLS’ COMPUTERIZATION IN MEETING INSTRUCTIONAL NEEDS IN SELECTED SCHOOLS IN KITUI COUNTY, KENYA

NDIRANGU JOSEPH KAMAU

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A RESEARCH THESIS SUBMITTED FOR THE DEGREE OF MASTER OF EDUCATION IN THE SCHOOL OF EDUCATION OF KENYATTA UNIVERSITY

JULY, 2012
DECLARATION

This thesis is my original work and has not been presented for a degree in any other university.

Signature .................................. Date ................................

Name: Ndirangu Joseph Kamau

Registration Number: E55/CE/11281/07

This thesis has been submitted for review with our approval as university supervisors.

Signature .................................. Date ................................

Dr. D. Khatete

Department of Educational Communication and Technology

Signature .................................. Date ................................

Dr. N. Gitau

Department of Educational Communication and Technology
DEDICATION

To my wife, Muthoni, my sons, Ndirangu and Gichuru and all those who believe in sustainable educational technology in our schools
ACKNOWLEDGEMENT

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To them all, I say thank you.
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<tr>
<td>CDMA</td>
<td>Code Division Multiple Access</td>
</tr>
<tr>
<td>GoK</td>
<td>Government of Kenya</td>
</tr>
<tr>
<td>GPRS</td>
<td>General Packet Radio Service</td>
</tr>
<tr>
<td>ICT</td>
<td>Information and Communication Technologies</td>
</tr>
<tr>
<td>IT</td>
<td>Information Technology</td>
</tr>
<tr>
<td>KESSP</td>
<td>Kenya Education Sector Support Program</td>
</tr>
<tr>
<td>KIE</td>
<td>Kenya Institute of Education</td>
</tr>
<tr>
<td>LAN</td>
<td>Local Area Network</td>
</tr>
<tr>
<td>MoE</td>
<td>Ministry of Education</td>
</tr>
<tr>
<td>NEPAD</td>
<td>New Partnership for Africa’s Development</td>
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<tr>
<td>NGOs</td>
<td>Non-Governmental Organizations</td>
</tr>
<tr>
<td>OECD</td>
<td>Organization for Economic Co-operation and Development</td>
</tr>
<tr>
<td>PE</td>
<td>Personal Emoluments</td>
</tr>
<tr>
<td>RMI</td>
<td>Repairs Maintenance and Improvement</td>
</tr>
<tr>
<td>TCO</td>
<td>Total Cost of Ownership</td>
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</table>
ABSTRACT

One of the main problems in deployment of computer technology in Kenyan schools is unclear objectives and misplaced priorities. Many schools have initiated expensive computer projects, whose sustainability is questionable. The software installed in these machines might not be tailored to meet specific instructional needs and therefore computers are likely to be underused and unappreciated by those they were meant to benefit. This study sought to assess the sustainability of these projects and their appropriateness in meeting teaching and learning needs in Kitui County, Kenya. Users' accessibility to computers, project costs, specific instructional needs and user-friendliness of hardware and software was investigated. To achieve these objectives, the study investigated a host of indicators identified during the literature review. These indicators included financing initiatives, the nature and numbers of computers, availability of digital content, and the level of ICT skills among teachers. The study employed survey design. Quantitative and qualitative approaches were used in the collection and the analysis of data. The target population consisted of teachers, students and administrators in provincial secondary schools. Six out of 19 provincial secondary schools were purposively selected. A sample size of 120 randomly selected teachers of various subjects, 6 principals, 6 teachers of Computer Studies and 163 students participated in the study. The researcher used questionnaires, interview schedules, checklists and document analysis in data collection. Collected data was scrutinized for completeness and analysed using MS-excel for quantitative and CDC EZ-text software for qualitative data. It was then presented by using relevant themes, tables and percentages. The findings of the survey revealed that Schools lack a comprehensive ICT policy to guide acquisition, use and sustenance of computerisation. Consequently, they did not have reliable financing arrangements to set up and run computerization. The study observed that this inadequate funding impacted negatively on the number of useable machines and the availability of up-to-date user-friendly software, severely hampering access to the machines and digital content. In addition, the study found out that although the teachers and learners are aware of their ICT instructional needs, there is little content in schools that can be integrated in teaching and learning. The study concluded that secondary school computerization is neither adequate nor sustainable in its current state. The researcher recommends that the government should get more involved in establishing ICT centres in schools and in conducting a sensitization campaign to equip teachers with knowledge on ICT integration into their daily instruction tasks. The findings of the study have implications for teachers practices and the policy approach to secondary computerization. These results can be used by school administrators as a benchmark for improving ICT policies in their schools and to facilitate optimum access to and productive use of available computers. These results can also be used by the government to improve e-preparedness of schools as we move towards the realization of computerization of all schools by the year 2012. Finally, suggestions for further research are made.
CHAPTER ONE

INTRODUCTION

1.1 Background to the problem

The importance of Information and Communication Technology (ICTs) to a developing country like Kenya cannot be overemphasized. The computer has especially become a basic tool at home, in schools and even in workplaces. Information and Communication Technologies (ICTs) are increasingly getting accepted and integrated in teaching, learning and research activities in education, both internationally and locally (Ouma 2003; Agbonlahor 2005). The changing trends in education demand a shift from traditional methods of teaching and learning. Education administrators and teachers have to embrace information technology to make the learning process more interesting, innovative and worthwhile. In a Ministry of Education paper, *ICTs in Education Options Paper* (2005), it is noted that there are obvious benefits for integrating computers into secondary schools as students at this age need to focus on subject-specific content, greater critical thinking skills, scientific inquiry, and mathematics, science and languages. The paper argues that students will benefit greatly with the analytical, creative, and collaborative power of computers to map out and analyze assumptions, present ideas, and participate in projects with peers from around the country and around the world.

The choice to integrate ICTs is driven by the potential and actual benefits that accrue from the use of ICT, such as expanded access to education and improved educational quality if students are put at the centre of an engaging and active learning process (Takiya, Archbold et al. 2005).
Use of ICTs can offer a rich choice of learning experiences that are appropriate to needs, space, pace, aspirations and learning styles (Flood 2002). Learning and training could become interactive in contrast to the one way delivery system of traditional face to face teaching. It even promotes self learning skills (Mugimu 2006). At the level of the whole system ICTs can be used to provide consistent, worldwide training, reduced delivery cycle time, and improved access to information resources and education (Gregorian 2002; Huyer & Sikoska 2003) The government on its part has stressed the urgent need to computerize schools. One of the educational priorities outlined in Sessional Paper No. 1 of 2005 titled *A Policy Framework for Education, Training and Research*, is computerization of all schools by the year 2012. According to this paper, the government intends to improve access, equity and quality in the delivery of education services in Kenyan schools. It also aims at producing human capital with skills that are demand-driven. In addition, the Kenya government published the National ICT Policy in January 2006 and the National ICT Strategy for Education and Training in June 2006 to guide and promote issues of ICT in the country.

In recent times, there has been a global explosion in the use of computers in schools as an instructional, communicative and informational resources tool. Jonassen (1996) explains this global proliferation by saying that when students use databases, spreadsheets, multimedia, e-mail, and network search engines to complete their projects, such processes provide greater potential to promote cognitive development. According to (Johnston, 1987; Budin, 1991; Rose & Ferlund, 1997; Shavinina, 1997; Thomas, 2003), computers raise the potential to equip students with higher-order skills such as inquiry, reasoning, problem solving and decision making abilities, critical and creative thinking and learning how to learn. Cuban (2001) considers computers a vehicle for reforming educational practices, to be used as an instructional tool by
teachers at all levels of education. Pelgrum (2001) states that using computers could revolutionize an outmoded educational system; better prepare students for the information age and accelerate national development efforts. McAllister and Mitchell (2002) add that using computers will make the learning process exciting for both students and teachers.

Rose and Fernlund (1997) stress that using computers in teaching Social Studies makes the learning-teaching process meaningful, integrated and active. Mason et al (2000) argue that using technology in social studies teaching provides unforeseeable facilities and makes effective learning more accessible, compared to traditional classrooms. Akengin (2007) states that the content of social studies is generally abstract because it is concerned about people, history, culture, flora, landscape, climate; therefore using information technology enables students to understand these facts easier and make them participate in the learning process more actively.

Huckel et al (1969) believe that the benefit of using computers in teaching social studies, particularly in geography, has been known for a quarter a century. Hassell (2000) presents several uses for computer in geography: presentation packages, data logging (weather), data handling (databases and spreadsheets to analyze information), simulations and modeling software, mapping and graphic information, GIS (geographic information system), digital images, electronic communications, multimedia authoring machines and information rich sources (CD-ROM and World Wide Web). Davidson (1996) mentions that computers can be used by geography teachers as a teaching–learning tool and as a tool for data collection analysis in fieldwork.

Improved secondary education is fundamental to the creation of effective human capital in any country. The crisis facing human resource development in Africa is clearly manifested in the
secondary education sub-sector in forms of limited access and poor quality (Evoh, 2007). The World Bank (2005) report titled *Expanding Opportunities and Building Competencies for Young People: A New Agenda for Secondary Education*, describes secondary education as the crucial link between primary schooling, tertiary education, and the labour market. As the World Bank (2005) notes, the task confronting education policymakers in Africa is to transform secondary education institutions and current schooling practices to align them with the fast growing demands of globalization and the technology-driven world. Thus, the main focus of the education policy process in Africa is to address the twin challenges of increasing access to, and improving quality and relevance of secondary education for all young people in the region. This underscores the imperative to transform teaching and learning in primary and secondary schools in Kenya. The need for the integration of ICT in secondary education in Africa is underscored by two main factors, namely: expanding secondary education access to marginalised communities; and to improve the quality and value of secondary education in Kenya (World Bank, 2005). Secondary education is of strategic importance to Africa’s development and capacity building, particularly because students of secondary school age and young people in general make up more than 60 percent of the population of Africa (Bregman, & Stallmeister, 2002; Lewin, 2004; Akoojee & McGrath, 2005). Unfortunately, many African countries are unable to meet the increasing demand for secondary education due to their inability to build on the successes of the universal primary education system.

Despite the recognized roles of Information and Communication Technologies (ICTs) in improving the quality and quantity of education, ICTs remain a low policy or financial priority in most educational systems in Africa (Evoh, 2007). Evoh argues that most countries in the region lack the necessary capacity and financial muscle to facilitate sustainable integration of ICTs in
education. This is true because African countries have to contend with a myriad of development challenges. These range from budgetary constraints, management challenges, and shortage of teachers and other educational resources, to the dreadful impacts of HIV/AIDS on education. These priorities therefore compete with ICT interventions for attention. While all countries in the region acknowledge the strategic role of ICTs in development, only a couple of countries in Africa have established a comprehensive policy for the integration of ICT in education (Evoh, 2001). Where such policies exist, they tend to remain vague and make little reference to implementation (James, 2001). James further states that ICT in education policy needs to establish itself within the set of competing priorities. However, given the urgency of educational needs in the region, particularly at the secondary school level, the establishment of such policy domain is overdue. It is against this background that the researcher sets out to critically evaluate the status of secondary school computerization ventures in the light of real education needs of both teachers and learners.

1.1.1 The government's initiative – Policies and Strategies

The government of Kenya promulgated a National ICT Policy in January 2006 that aims to “improve the livelihoods of Kenyans by ensuring the availability of accessible, efficient, reliable and affordable ICT services.” The national policy has several sections, including information technology, broadcasting, telecommunications, and postal services. However, it is the section on information technology that sets out the objectives and strategies pertaining to ICT and education. The relevant objective in this section states that government will encourage “...the use of ICT in schools, colleges, universities and other educational institutions in the country so as to improve the quality of teaching and learning.”
The related strategies, under the heading “e-learning,” are to promote the development of e-learning resources; facilitate public-private partnerships for resource mobilisation; promote the development of an integrated e-learning curriculum; promote distance education and virtual institutions; promote the establishment of a national ICT centre of excellence; provide affordable ICT infrastructure to facilitate dissemination of knowledge and skill through e-learning platforms; promote the development of relevant digital content for schools; create awareness of the opportunities offered by ICT as an educational tool; facilitate sharing of e-learning resources between institutions; exploit e-learning opportunities to offer Kenyan education programmes for export and integrate e-learning resources with other existing resources in the education sector.

In the education Sector, the Ministry of Education developed a Kenya Education Sector Support Program (KESSP) in 2005 that featured ICT as one of the priority areas with the aim of mainstreaming ICTs into the teaching and learning process. The National ICT Policy embedded this intent as a national priority and provided the impetus for the Ministry to develop its sector policy on ICT in Education (World Bank, 2007).

In June 2006, the Ministry introduced the National ICT Strategy for Education and Training. This document, referred to as the ICT policy for the Education Sector, consists of the following components, each with its own statement of strategic objectives and expected outcomes:

1. ICT in education policy
2. Digital equipment
3. Connectivity and network infrastructure
4. Access and equity
5. Technical support and maintenance
The government therefore supports ICT’s integration in education. However, the current computerization in Kitui County has not been evaluated for adequacy and sustainability. Finding out whether the hardware and software in schools is adequate in relevance and numbers is the concern of this study.

1.1.2 Reflections on Adequacy and Sustainability

Secondary school computerisation needs to be evaluated for adequacy and sustainability. Adequacy comprises the capacity of computer equipment and software to satisfy the needs of learners and teachers. The numbers of computer have to be sufficient for a specified number of users and the software has to be tailored to meet specific needs of the users. Moreover, specific ICT skills have to be developed among the users to complete this picture of adequacy. On the other hand, sustainability is the ability of school computerisation to carry on over time and provide value for money over that period. This includes the schools’ ability to initiate computerisation and keep it running by way of footing bills emanating from recurrent expenditure. Moreover, schools should have sound administrative structures that facilitate purchasing of equipment and software, foster accessibility, and pursue development of ICT literacy among teachers and learners. It is only when computerisation is adequate and sustainable that ICT integration in class can lead to the meeting of instructional needs in secondary schools.
1.2 Statement of the Problem

In spite of the rest of the world advancing greatly in the use of computers, the big percentage of Kenyan secondary schools remains in a time warp. Computer education was introduced in public secondary schools with effect from 1998 as an optional subject examinable in the fourth year of secondary school (Technet, 2003) as cited in Inyega and Mbugua (2005). However, more than ten years later, the extent of computer use in teaching and learning remains low or non-existent. In secondary schools, little emphasis is put on inquiry as an instructional strategy (Sanya, 2001). This scenario is unfortunate since computers in schools could make a big impact with the application of computer assisted learning and the usage of the Internet.

Though all provincial schools in Kitui County have acquired basic computer equipment, the impact of computerisation in these schools is not evident at all. Little is known about the extent to which they are adequate in meeting learning and teaching needs. This raises the question of suitability of computers, software and related peripherals. Adequate computerisation should be sustainable. In Kitui County, no study has been carried out to document the fitness of purpose of these computerization initiatives in meeting real instructional needs. Also, long-term sustainability of these initiatives is unknown. The issue of adequacy and sustainability should be central to the introduction of any educational technology in schools if such technology is to serve both teachers and learners in meeting learning objectives. This study sought to evaluate the adequacy and sustainability of school computerization in meeting instructional needs by looking at the pertinent indicators in selected secondary schools in Kitui County.
1.3 Purpose of the study

The purpose of this study was to investigate whether computer use in secondary schools in Kitui County is adequate and sustainable using Bates (1995) ACTIONS model. The study also examined the extent to which computerization in these schools is adequate in meeting the instructional needs of both teachers and learners.

1.4 Objectives of the study

To achieve the purpose of this study, the researcher pursued the following objectives:

(i) To examine the accessibility, interactivity and user-friendliness of computer hardware and software to teachers and students in secondary schools.

(ii) To assess the cost of acquiring, installing and maintaining computer equipment in secondary schools.

(iii) To investigate the ICT teaching and learning needs of teachers and students in secondary schools.

(iv) To investigate how the school organizational structure influences the accessibility and use of computers for teaching and learning in secondary schools.

(v) To establish the types of instructional resources available in secondary schools that can be integrated in ICT instruction.

1.5 Research questions

The following research questions guided this study.

(i) How do schools finance acquisition and maintenance of computer hardware and software?
(ii) What kind of hardware and software are in use in secondary schools? Is it tailored to meet specific teaching and learning needs?

(iii) What instructional needs do teachers and students want to see satisfied by ICT’s in their schools?

(iv) What organisational factors hinder or facilitate accessibility to computers for teachers and students in secondary schools?

(v) What instructional resources are available in schools that can be integrated in ICT instruction?

1.6 Significance of the study

This study provides information that will guide policy makers and implementers of the National ICT Strategy for Education and Training by documenting pertinent ICT needs in secondary schools. The study has shed light on the readiness of schools to implement the National ICT strategy on Education and Training (2006) as we move towards computerization of all schools by 2012. Findings from this study can be used by school administrators as a benchmark for improving ICT adequacy in their schools and to ensure sustainable use of computerisation in meeting teaching and learning needs. They can also be used by trainers of teachers to design ICT courses relevant to the needs of teachers.

1.7 Scope

The scope of this research entailed studying the adequacy and sustainability of ongoing secondary school computerization in schools that have had fully-fledged computer labs for at
least three years. The research did not include schools that use computers for administrative purposes only. This study focussed on six secondary schools in Kitui County.

1.8 Limitations of the Study

This research is limited to the study of the costs of computerisation, assessment of accessibility to hardware and software; identification of ICT instructional needs, the administrative factors that influence sustainability and adequacy and the documentation of available instructional resources that can be integrated in ICT instruction. Teachers, students and school administrators were sampled for use in the study. Generalization of findings is confined to other schools of the same calibre elsewhere in the country. Since most data was collected through self-completed questionnaire, there may have been an element of subjectivity. The study was also limited to little amount of funding and the short time available to collect the data.

The survey was guided by the ACTIONS model (Bates, 1995), whose details are explained later under the theoretical framework.

1.9 Research assumptions

In this study, it was assumed that:

(i) Teachers and administrators use available computers and other resources.

(ii) Computers are acquired to facilitate teaching and learning in schools.

1.10 Theoretical Framework

All empirical studies must be based on some theory. In this study, the researcher used the ACTIONS model (Table 1.1) to determine the viability of existing computer projects in schools,
with reference to the model. This model was designed by Bates (1995), and was originally meant for assessing the appropriate choice of technology for use in open and distance learning. It was meant to be a tool for use when deciding suitable technology when delivering course content to students undertaking distance learning. The various aspects of the actions model provided a measuring scale that enabled participants make appropriate choice of the technology they needed. The users determine whether this technology is accessible, cost-friendly, the kinds of learning it supports; the interactivity of the technology; organizational requirements necessary, the newness of this technology and speed at which lessons can be mounted using the chosen technology. This model is presented on the next page with some modifications. While the original was meant for use when making choices among various technologies, the researcher adapted the various aspects of the model for use in assessing whether computer technology is adequate and sustainable in meeting instructional needs in secondary schools. The model is presented as table 1.1
## Table 1.1: The ACTIONS model

<table>
<thead>
<tr>
<th>Column</th>
<th>Description</th>
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<tr>
<td>A</td>
<td>Access: How accessible is computer hardware and software for teachers and learners? What is the user-computer ratio in schools?</td>
</tr>
<tr>
<td>C</td>
<td>Cost: What is the cost setting up and running school computerization? What is the unit cost per learner?</td>
</tr>
<tr>
<td>T</td>
<td>Teaching and learning needs: What are the ICT needs of learners and teachers? What instructional approaches can meet these needs? What are the ICT’s available for supporting this teaching and learning?</td>
</tr>
<tr>
<td>I</td>
<td>Interactivity and user-friendliness: What kind of interaction do available computers enable? How easy is it to use? How user-friendly is school computerization?</td>
</tr>
<tr>
<td>O</td>
<td>Organizational structure: What organizational factors are evident to facilitate computerization? Are there policies to regulate computerization? Has the administration instituted skill development to enable use of this technology?</td>
</tr>
<tr>
<td>N</td>
<td>Novelty: How new is the computer equipment? How current is the software available in schools? How relevant is such software?</td>
</tr>
<tr>
<td>S</td>
<td>Speed: How quickly can lessons be conducted with available computers? How quickly can materials be changed?</td>
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Adapted from Bates (1995)

The original was meant for use when making choices among various technologies. For the purposes of this study the researcher adapted the various aspects of the model for use in assessing adequacy and sustainability of school computerisation in meeting instructional needs in secondary schools.
1.11 The conceptual framework

From Bates (1995) model and from literature review, the variables for the study were identified and conceptualized as shown in Fig. 1.1. Secondary school computerization can only be helpful if it is adequate and sustainable. These two key constructs can be viewed in terms of the various aspects that constitute the independent variables of this study. These are accessibility, user-friendliness of the technology, cost of hardware/software and the organizational capacity to facilitate setting up, running and utilization of school computer system. These variables are the elements of school computerization that determine whether such computerization has the capacity to meet ICT teaching and learning needs, which form the dependent variables. These dependent variables are ICT instructional needs. These include provision of authentic learning experiences through the use of models and simulations; and access to information. Also teachers use the technology in the preparation of lesson notes, lesson plans, schemes of work and examination papers. When all independent variables are evident in a school computer system, we expect improved quality in instructional design and enhanced inquiry skills and sharing of information.
Fig. 1.1: A Conceptual Framework of Adequacy and Sustainability of Secondary Schools Computerization.

**SCHOOL COMPUTERIZATION**

**ADEQUACY**

**ACCESS**
1. Users-computer ratio
2. Location
3. Access to ICT skills
4. Access to the Internet
5. Access to digital content

**INTERACTIVITY**
1. Status of Hardware (age, models, peripherals)
2. Software - newness

**SUSTAINABILITY**

**COST**
1. Fixed costs
2. Recurrent costs

**ORGANIZATIONAL FACTORS**
1. ICT policy
2. Budget
3. Skill development
4. E-waste management

**INDEPENDENT VARIABLES**

**DEPENDENT VARIABLES**

Effective computer use in meeting instructional needs
- A Teaching aid – preparation of lesson notes, lesson plans, schemes of work, Preparation of exam papers
- Authentic learning experiences (models & simulations)
- Access to information (the Internet, e-content applications, digital archives)
- Quality instructional design
- Communication - sharing information
- Storage and retrieval

Source: Researchers own
### 1.12 Operational Definition of terms

<table>
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<tr>
<th>Term</th>
<th>Definition</th>
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<tr>
<td><strong>Adequacy:</strong></td>
<td>Fitness of purpose: the sufficiency of a computerization project in quality or quantity to meet teaching and learning needs.</td>
</tr>
<tr>
<td><strong>Computerization:</strong></td>
<td>To install or start using a computer system to organize, control, or automate school programmes as well as use of computers as a teaching aid and as a resource. For the purposes of this study, Computerization is used synonymously with ICT</td>
</tr>
<tr>
<td><strong>Computer-literate:</strong></td>
<td>Able to use computers: having a good understanding and experience of working with a computer or computer system</td>
</tr>
<tr>
<td><strong>e-learning:</strong></td>
<td>The acquisition of knowledge and skill using electronic technologies such as computer- and Internet-based courseware and local and wide area networks</td>
</tr>
<tr>
<td><strong>Secondary education:</strong></td>
<td>The second cycle of the 8-4-4 system of education covering forms 1 to form 4. (definition meant for this study only)</td>
</tr>
<tr>
<td><strong>ICT's:</strong></td>
<td>A term used to refer to computers, software, networks, satellite links, optical fibre links, and related systems that allow people to create, access, analyze, organize, exchange and use data, information and knowledge.</td>
</tr>
<tr>
<td><strong>Internet:</strong></td>
<td>The infrastructure that brings together people in different places and time zones with multimedia tools for data, information and knowledge management to expand teaching and learning capabilities.</td>
</tr>
<tr>
<td><strong>ICT instructional needs:</strong></td>
<td>Specific educational needs that can be addressed using computers. These include access to references, development and communication of ideas, enhancing inquiry skills and education outcomes.</td>
</tr>
<tr>
<td><strong>Sustainability:</strong></td>
<td>The ability embodied in a programme to continue for a long time or to be maintained. Sustainable computerization is one that meets the needs of the school by accounting for specific equipment, software, skilled manpower and other related infrastructure that comprise Total Cost of Ownership (T.C.O.).</td>
</tr>
</tbody>
</table>

### 1.13 Summary

This chapter presented the background to the study, the problem identified, and the research objectives and questions stated. The theoretical framework was discussed and a conceptual framework presented. Lastly, operational definitions of terms were provided.
CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

In this chapter, the related literature is explored and organized in form of subtopics. Insights into the state of ICT use, adequacy and sustainability of computerisation in schools are provided. This literature is then organized into various subheadings.

2.2 The Rationale for ICT in Secondary Education in Kenya

It is generally agreed that computer technology can radically improve the way the education curriculum is designed and implemented. Evoh (2007) in a paper *Policy networks and the transformation of secondary education through ICTs in Africa: The prospects and challenges of the NEPAD e-schools initiative*, argues that many professionals have acknowledged the fact that investment in ICTs is an investment in human capital development. Evoh goes on to say that such investments are essential in order to meet the demands for new meanings of "school" and "learning," within the larger process of education reform. Various terms have been coined for this technology-enhanced education, such as information society, e-learning, and e-school.

In the *National ICT Strategy for Education and Training* (2006), it is indicated that ICT has the potential to play a more powerful role in increasing resources and improving the environment for learning. This document maintains that ICTs can also play a role in preparing students to acquire skills, competencies and socio skills that are fundamental for competing in the emerging global "knowledge" economy (GoK, 2006).
The question of access to quality education is key to all concerned in the education sector. In order to improve access and quality of education, among other strategies, the Kenya government in *Vision 2030*, has pledged to introduce e-learning as an alternative mode of delivery of education (GoK, 2007). This means that ICT can supplement the traditional classroom teaching by widening availability of education content through the use of the Internet and production of interactive content on CDs and DVDs.

The Kenyan education sector faces many challenges and therefore it may seem unreasonable to invest heavily in ICT. However, the introduction of ICTs in secondary school will mitigate the effects of inadequate teachers and print education material and raise the level of independent learning among the learners. Osin (1998) says that ICTs in education and basic needs in the developing countries are not contradictory or conflicting interests. The objective of integrating ICT in secondary education cannot be pursued in isolation but rather it should be seen as an integral part of the overall strategy for knowledge creation and the improvement of educational system in Africa (Evo, 2007).

The rationale for integrating ICTs in education was given in a report issued by the Organization for Economic Co-operation and Development [OECD] (2001) on the impact of ICT in schools. These were as follows:

- Economic rationale which has a focus on the perceived needs of the economy and the requirements to meet the skill and learning needs of the information economy;
- Social rationale which focuses on facility with ICT becoming a prerequisite for participation in society and employment, so that ICT competence is seen as an essential life skill and a basis for maintaining employability throughout life;
• Pedagogical rationale which concentrates on the role of ICT in teaching and learning and the ways in which ICT can increase the breadth and richness of learning, foster motivation for learning, and support the development of higher-order thinking skills (OECD, 2001).

Generally, the expected advantages of integrating ICTs in secondary education in Africa are: effective curriculum delivery by teachers as facilitators; improved learning by raising curiosity; technological literacy among students; expanding educational access to remote communities that were formerly deprived of education due to distance, culture, economic needs or gender disparities; and to prepare students for the world of work (Evoh, 2007, p.7).

Although understanding the rationale for introducing computers in various schools in Kitui County was not part of the focus of this study, it helped the researcher in appreciating the objectives of computerization in various schools. This actually formed a basis upon which to assess its adequacy in meeting educational needs.

2.3 The State of Computerization in secondary schools in Kenya

Despite the recognized roles of ICTs in improving the quality and quantity of education, computerization remains a low policy or financial priority in most secondary schools in Kenya. Many schools lack the capacity and financial wherewithal essential for a sustainable integration of ICTs in teaching-learning and management. The costs are also prohibitive. Technical training can be very expensive since all the equipment must be imported using scarce foreign exchange reserves (Ngware & Nafukho, 2002).
Owing to budgetary constraints, the existing computerization projects in secondary school are funded by various bodies. The most notable one is the NEPAD e-school initiative, which is a result of African governments, the private sector, foundations, development agencies and civil society organizations coming together for a common ICT project in education, developed and driven by Africans and for Africa (Chasia, 2004). Other initiatives are by various NGOs and religious organizations but their efforts are often uncoordinated and result to haphazard computerization, devoid of rationale or sound strategy. Ford, (2007) and Kessy, (2006) concur that in developing countries, efforts are often uncoordinated and initiatives are in competition with each other rather than complementing each other. In addition, they note there are many unsustainable ICT programs where schools have unserviceable computers as resources meant to keep them running are often redirected and misused.

To be effectively adopted, ICT requires good governance and appropriation of allocated government funds and foreign aid. In many developing nations lack of ICT policy, poor ICT project management, and corruption has led to ineffective implementation, adoption of different systems and standards, duplication of effort, and waste of technology resources (Wanjira, 2009).

In spite of the increased ICT use in all sectors, the level of ICT use in schools is still wanting. In a study by Wabuye (2003), results indicated that while ICT has penetrated many sectors including banking, transportation, communications, and medical services, the Kenyan educational system seems to lag behind. The study found that computer use in Kenyan classrooms is still in its early phases. Ford, (2007) reports that there are about 4000 secondary schools with 85% of those being located in rural areas. Sixty-five percent of those schools have
electricity. Only about 750 schools have an average of 10 computers each although internet connectivity is limited.

The biggest limitation to the use of technology in Kenya is poor infrastructure (Adhola, 2004; Sanya, 2001). Provision of telephone facilities still remains far below the current demand. Many of the lines that exist are either out of date or dysfunctional, interrupting connections to the information superhighway. The use of electricity is limited mainly to urban centres. Therefore, few rural schools are able to incorporate the use of computers.

Several reasons have been cited to account for under-use of ICT in education in the African context. The cost of adopting ICT including purchasing hardware and software, setting up networking, and the maintenance and repair of facilities is often prohibitive for developing nations. This also makes it difficult for institutions to maintain Internet connections (Kessy et. al. 2006 – as cited in Wanjira Kinuthia, 2009).

For most developing nations, the dynamic nature of technology is difficult to keep up with, often forcing teachers to use traditional teaching methods and less effective instructional technology techniques. Most institutions still use nearly obsolete systems and are consequently unable to exploit the educational potential of the emerging technologies. There was need to come up with mechanisms to encourage educational institutions to keep abreast and to harness emerging technologies to improve effective and quality delivery of education services and curricula (Government of Kenya, 2006).

In response to the above, schools could make use of Open Educational Resources as this allows users to freely create and distribute software and educational resources without the prohibitive costs or licensing limitations. It is also suggested that governments can seek concessions with
companies such as Microsoft for discounted software. Progress has been made with using open source computer operating systems and software being localized to the languages and contexts with examples of Microsoft® and Google® which now have Kiswahili applications (Johnstone, 2005; Coppola and Neelley, 2004; Kessey et al, 2006 – as cited in Wanjira, 2009).

Since IT infrastructure is available in all provincial schools, the researcher is interested in finding out whether the available equipment is sufficient in meeting instructional needs of those schools.

2.4 Costs and the Question of Sustainability

Cost is a strong discriminator between technologies (Bates, 1995). In developing countries that have to deal with constrained budgets, financial allocations to ICT must properly take into account the full costs of sustainable ICT systems as well as address the challenge of providing ICT on an equitable basis. Education planners must investigate costs related to ICT so that key strategic questions around effectiveness, efficiency and sustainability can be better understood. Such an understanding is particularly important, given that sometimes wildly extravagant claims are made for ICT and its impact on education processes (Patterson, 2007).

Therefore, the long-term sustainability of initiatives like the schools project will remain questionable until African countries can demonstrate their ability to locally produce and maintain the technological software and hardware needed. Thus, there is the urgency for the training and development of indigenous skills and capacities in various African countries to service the emerging ICT sector in the region (Evoh, 2007).
Infrastructure requirements are costly and involve various stakeholders in developing countries, largely because the cost barriers to supplying ICT hardware, software and connectivity in these education environments are significant (Evoh, 2007). In developed countries there is a growing realization of what in 1996 Oberlin called the ‘financial mythology of information technology’ which he described as follows: “While the per unit price of information technology is declining rapidly ... the total cost of owning and maintaining systems is steadily rising ... the falling prices mislead many to expect cost savings that will never materialise” (Oberlin, 1996:p.21). This was largely because of consistent underestimation of the management, technical support, curriculum development and training expenditure that is essential to ensure sustainable ICT access and use in education. Given global enthusiasm for applying ICT in schools, higher education institutions and in national education systems, it is essential to put in place appropriate costing, financing and planning processes to aid budget allocation decisions.

The National ICT Strategy for Education and Training states that levels of poverty hinder access to ICT facilities, limited rural electrification and frequent power disruptions. Where there is electricity, hindrances to application of ICT include high costs of Internet provision, costs associated with digital equipment, inadequate infrastructure and support (Government of Kenya, 2006). The policy makes a commitment for provision of digital equipment to educational institutions, particularly colleges, secondary and primary schools. Whereas most secondary schools in Kenya have some computer equipment, only a small fraction is equipped with basic ICT infrastructure (Government of Kenya, 2006). In most cases, equipment of schools with ICT infrastructure has been through initiatives supported by the parents, government, development
agencies and the private sector, including the NEPAD E-Schools programme. (Government of Kenya, 2006)

A much more important and critical component is the licensing of education software and related costs, which are prohibitive given the high levels of poverty in the country. In a study conducted in Keiyo District, results highlighted a complete dependency on licensed software and standard Microsoft® applications such as MS Word® and MS Excel®, and the absence of any educational software (Wims & Lawler, 2007). This is in spite of the commitment of the government of Kenya that the development and deployment of Open Source software for public and private sector would be encouraged (Kenya Government, 2004b:p.14 – as cited in Wims and Lawler, 2007).

To develop and maintain schools computerization is expensive. Various studies show that effective and sustainable integration of technology in education is financially intensive. Unplanned introduction and application of ICT in education “without a sustainable model that includes ownership by beneficiaries can intensify existing inequalities in society, and reinforce an internal chasm separating the “haves” and “have-nots” in the society”. Similarly, sustainable approaches that have been tested and implemented in the advanced countries cannot serve as benchmarks for African countries (Hawkins, 2002; Akinsanmi, 2005 – as cited in Evoh, 2007). It is apparent that African countries, Kenya included are not in a position to formulate and implement expensive ICT in education projects alone. The National ICT Policy (2006) promises to facilitate public-private partnership so as to mobilise resources for supporting e-learning initiatives (GoK, 2006).
One of the aims of this study is to consider the costs associated with installing software, hardware and peripherals in school computer rooms, as well as recurrent expenses, human resources, training and management and administration costs. In this study, ‘total cost of ownership’ (TCO) a methodology that derives from management of computers in business environments, is used as a framework to identify costs. TCO draws attention to the importance of obtaining an appropriate combination of purchases, inputs and activities in order to operate a sustainable ICT environment. This implies that failing to fund key elements may fatally undermine the success of the whole ICT financing programme (McKenzie, 2003:p.1). In this way costs must be related to financing within a time-based budget allocation framework that in turn is informed by policy. There is evidence of schools and school districts in a number of developed countries applying TCO methods in financial planning and management of ICT facilities. In this study, the concept of TCO was applied in secondary schools, in order to better understand the financial challenges facing them in financing computerization projects. Using a TCO approach and method can contribute to understanding and achieving an appropriate balance between the strategic inputs required to sustain ICT facilities in individual schools (Patterson, 2007).

Due to the cost of investment, an effective and sustained technology intervention in secondary education cannot be unilaterally implemented by African governments, hence the need for multisectoral collaboration. The development strategy of collaborative partnership on which the initiative is launched has been tested as a rewarding method of development delivery in parts of Africa (Patterson, 2007).
In this study, the researcher sought to establish the total cost of ownership of school computer projects. Also, the various financing initiatives evident in secondary school computerization programme in Kitui County were documented.

2.5 Access to ICT for Teaching and Learning

Access to ICT is considered a basic right of 21st century citizenship (Murdoch, 2002). The government of Kenya recognizes the need to improve access to ICT facilities for the educational purposes as well as to facilitate universal access and equitable distribution to ICT infrastructure in both the formal and non-formal education sectors. It also aims at promoting access to ICT infrastructure by connecting all remote educational institutions through the Internet and support establishment of a National Educational Portal (NEP) (Government of Kenya, 2006).

For learners and teachers to benefit from computerization, it is desirable that they access the necessary hardware and software relevant to their immediate needs. Warschauer (2003c) argues that the very resources that people need access to are the same resources to which they were able to contribute. Thus access and use are closely inter-related: access to resources and the use of resources are inter-dependent (Czerniewicz & Brown, 2005). The authors further maintain that ICTs do not have any meaning in isolation – they have meaning only in relation to an implicit or explicit purpose. That purpose is the way they acquire meaning; this in turn contextualizes them. A discussion about access to ICT must therefore make explicit what its envisaged purpose is, or might be (Czerniewicz & Brown, 2005).
In the National ICT Strategy for Education and Training (2006), the Ministry of Education acknowledges that access to ICT facilities is currently one of the major challenges in Africa—Kenya is no exception. While the ratio of one computer to 15 students is the norm in most developed countries, the ratio in Africa stands at one computer to 150 students. This ratio is even wider in disadvantaged regions and areas. In Kenya, the ratio for secondary school level is one computer to 120 students (Government of Kenya, 2006).

Past researches in Kenya have shown that access is a real problem. The Kenya SchoolNet research (2002) found that almost 40% of schools had less than ten computers, and therefore inadequate numbers for teaching and learning. More than 20% had less than five computers, indicating that the computers were largely for administrative purposes (SchoolNet, 2002). Only one third of schools surveyed had dedicated computer laboratories. The research also found that some schools were making use of very old equipment. The research also reported that Internet and fax were rare in the schools (SchoolNet, 2002). It was suggested that e-mail was yet to be recognised as a tool for collaboration among teachers as only one school had a website and only two reported having networked all their computers to the Internet (SchoolNet, 2002). It went on to assert that in those schools, access to the Internet was severely limited and when available, was only for administrative use (SchoolNet, 2002). In another study based on the experience of managers and computer teachers in eight schools in Uasin Gishu District, western Kenya, Ndiku (2003) focussed on the problems encountered in the implementation of educational ICT projects. The research identified the several critical problems. These were insufficient numbers of computers and peripheral devices; teachers’ lack of knowledge; inadequate software for instruction and inadequate technical assistance as the most important factors in inhibiting the
success of computer deployment projects (Ndiku, 2003). This rather bleak picture means that access to computers in Kenya has not been a priority on the ground.

Work done on ICT in education has tended to focus on access to the technical hardware and software, but it is becoming evident that these are essential but insufficient factors. There is need to move beyond the rhetorics of ICTs as artefacts which simply need to be acquired, to the recognition that integrating ICT in teaching and learning requires access to a much fuller range of resources. If we see personal resources, contextual resources and content resources also as important, we can plan differently and better design educational interventions. (Czerniewicz & Brown, 2005) Arising from available literature, the researcher in this study, investigated access in terms of Access to computers as a physical resource; access to relevant digital content and access in terms of literacy and ICT skills.

2.5.1 Access to ICT as Physical Technology

Availability of locally produced educational content is still a big challenge. Most textbooks, particularly local published ones, are not available in a digital format and are consequently not available for use in digital media. The principal challenge therefore is to customize or develop education software to meet local education requirements in teaching, learning and administration (Government of Kenya, 2006).

Since computers are used in mediated learning, this technology can be referred to as 'technology resources', which is defined as the tangible components of computers and associated telecommunication infrastructure. Clearly, access to ICT as physical technology is the primary...
access required for use in teaching and learning. ICT is not neutral since technology is never used in a vacuum, but is shaped by the social and cultural context where the use is taking place. Apart from that their location is important. This means that when investigating access to computers, we need also to ascertain their location, availability and adequacy for use (or fitness of purpose) (Vygotsky, 1978; Murdoch, 2002 – as cited in Czerniewicz & Brown, (2005).

In this study, in focussing on accessibility, the researcher’s specific aim is to examine adequacy of available computer equipment. Adequate equipment is practical and useable. Brown and Czerniewicz, (2005) define practical resources as control over when and to what extent computers are used. To serve our purpose, physical resources was expanded to incorporate practical considerations such as Student-computer ratios, location where computers are found and user-friendliness. These served as useful research indicators.

2.5.2 Access to Content Resources

Content resources refer to the availability of suitable digital material online either on the Internet or in other digital formats. Social scientists debating the agency-structure relationship have been criticised for neglecting content (Sewell 1992). It was not an object of interest for many of the researchers who theorised and explored access to ICT, although a handful stressed that scarcity of suitable content is a factor contributing to the schisms of digital divides (Garnett & Rudd 2002; Bridges 2002; Warschauer 2003c).

While researchers studying ICT use in developed countries may not identify content as critical, it cannot be ignored in our context. Content is essential to pedagogy. It is one of the three elements
in a triangle of interaction comprising C-T-S, with the C being Content T being Teacher (or expert or facilitator) and the S being Student (or learner or apprentice) (Garrison & Anderson 2002 – as cited in Brown and Czerniewicz, 2005). However Kenya lacks adequate educational content. The *National ICT Strategy for education and training (2006)*, recognises one of the principal challenges of establishing e-learning as developing and customising software to meet local education requirements in teaching and learning. It also identifies as critical prohibitive costs involved in obtaining licensed education software.

Most of the available text books are still in printed from. It is recognized in various documents that the national curricula developed at the Kenya Institute of Education (KIE) needed to be transformed from text to digital format in order to facilitate integration of ICT in delivery of education programmes (GoK, 2006: p9-10)

In response to the above, KIE as at December 2011, had since produced digital content in DVD format for standards 4 to 7 in Maths and Science and for form 1 and 2 in English, Kiswahili, mathematics, sciences, geography, History, agriculture, Home Science, computer and Business Studies.

Now that ICT makes online content part of the pedagogical process in secondary education, the researcher needs to know what access staff and students have to that content. There is need to know whether there is access to content that is relevant, locally produced and in the required form, whether it is considered adequate or lacking. In this study, the researcher will look at relevance, and availability of digital content.
2.6 Accessibility to ICT Literacy Skills

While there is little academic research on ICT access in secondary education, efforts to bridge the digital divide must be primarily about people, not just technology. (Brown & Czerniewicz, 2005). In order for individual students or academics to use ICT meaningfully for teaching and learning, they need access to their own personal resources. It is important to identify specific resources which need to be accessed by individuals in order to give them capacity to utilize available computer resources. This suggests that an ICT user in a social structure is more likely to become an agent when able to use or generate knowledgeability, power, commitment, and consciousness. (Etzioni in Lehman 2003) The need for accessing personal resources allows an individual to exercise agency, to give meaning to objects and events and to act with intent (Drislane, n.d.). What we need to know is which human resources are particularly necessary to enable staff and students to become agents who can mobilise resources and purposefully use ICT and how these may differ according to purpose. For example, are different personal resources required for teaching purposes as opposed to learning purposes?

It is also noted that teachers utilise computers more if they have access to literacy skills. In a study on Accessibility And Utilization Of ICTs Among Secondary School Teachers in Kenya, Kitptalam and Rodrigue, (2010) noted that teachers’ levels of access to the schools computers was positively linked to their basic ICT literacy skills. The study also revealed that majority of the teachers had access to a computer and the Internet at their schools.
The concept of knowledge is therefore important in enabling teachers’ access and use of computers for teaching and learning. The researcher therefore investigated the level of ICT literacy among the teachers by asking specific questions about experience and training, with a view to ascertaining whether it was adequate in meeting instructional needs.

Given anxieties and fears which exist generally about technology in society, the researcher will find out about individual interest in and attitude to using computers in general and specifically explore a person’s interest in and attitude to using computers for learning and teaching. Research indicators include interest, experience, knowledge, training, and skills.

2.7 Contextual Resources – Organisational Factors

In order to use ICT, people need access to resources in and from the context in which they function. These resources, together with mutually sustaining schemas, make up the structures that empower and constrain social action and that tend to be reproduced by that action (Sewell 1992:19 – as cited in Brown & Czerniewicz). These resources determine how conducive the environment is to using ICT and how enabling the context is of the integration of ICT for teaching and learning, specifically in secondary school.

In this section, the researcher will set out to identify which resources, forming part of the structure of human institutions, groups and organisations, need to be accessed in order to utilise ICT successfully for teaching and learning. Two key kinds of resources could be identified from the literature, these being firstly social resources (in the form of networks and support) and secondly formal enabling frameworks of various kinds. However, the researcher will only consider the formal environment that enables or hinders successful utilization of IT resources in
secondary schools. School management impacts directly on the use of and access to ICT resources. Earlier studies have highlighted the low priority given to this by school managers. The findings of a previous research stated that “the first computer sits in the Principal’s office, the second at the secretary’s desk or the bursar’s and the third goes to the computer laboratory” (Aguyo, 2004:155).

Many studies show that for a technology integration project to be successful, school administrative support is essential (Guilfoyle, 2006). With strong administrative support, teachers can be given the time and the resources to use technologies not only in their own teaching but also in sharing their experiences with other teachers. Besides school support, the process of technology integration can be expedited if parents and the community also show their respect and appreciation for such changes.

Any ICT investment in schools requires administrative support for it to succeed. Kitptalam and Rodrigue, (2010) observe that access rates for teachers were much higher in educational institutions that have made effective ICT investments in education, translating into better utilization of ICT related technologies with assumed positive impacts.

Certainly, aspects of institutional context in terms of policy and leadership are more tangible to teaching staff than to students. Institutional resources are defined as the integration of technology into the institution. Research indicators here are extent of integration, policy and support.
2.8 ICT Adequacy and Teaching and Learning needs

One of the most common problems of using Information and Communication Technologies (ICTs) in education is to base choices on technological possibilities rather than educational needs (Jaffer, Ng’ambi and Czerniewicz, 2007). The challenges lie in identifying and conceptualising ways that educational technology can usefully contribute to student learning experiences, curriculum and pedagogical designs.

Jaffer, Ng’ambi and Czerniewicz (2007) state that that design of educational technology interventions should be driven by educational needs within the context of a broader teaching and learning strategy which requires buy-in of both educators and learners.

The Ministry of education has National ICT Strategy ICT for Education and Training (2006) which highlights the potential of ICT to help support implementation of Free Primary Education (FPE) and to address emerging challenges such as; overcrowded classrooms, high Pupil Teacher Ratios (PTRs) particularly in densely populated and semi-arid areas, shortage of teachers on certain subjects or areas, and relatively high cost of learning and teaching materials.

While other countries have reported up to 41% of integration of ICT to teaching and learning, the proportion remains substantially low in Africa, Kenya included. Currently, there is limited capability for effective use and maintenance of ICT infrastructure at the educational institutions. Most schools use less than 40% of the available ICT infrastructure and therefore there is need to ensure optimum use of ICT resources by students, teachers and administrators in order to exploit
the educational potential of the technology. Furthermore, very few schools are using ICT as an alternative method for the delivery of the education curriculum (Government of Kenya, 2006).

The researcher assumes that teaching and learning needs can be quite narrowly defined. Educational needs met by using IT in secondary schools include developing understanding, extending access to sources, and enhancing enquiry skills, development and communication of ideas (Jaffer et al., 2007). Others include the need to develop citizens required in an information society (Government of Kenya, 2006); improving educational outcomes (especially pass rates) and enhancing and improving the quality of teaching and learning (Wagner, 2001; Garrison & Anderson, 2003).

The needs of learners and teachers are only satisfied if the technology is adequate. Computers have to fit the purpose of serving the pertinent needs of users. The results of a study by Brown and Czerniewicz (2005), suggests that user needs were about fitness of purpose. Kirkup & Kirkwood, (2005) and Wagner (2001) argue that it is the contextualised teaching and learning needs that ought to drive the ICT intervention, rather than the technology itself. The researcher agrees with Laurillard (2001) that it is important that educational technology-based resources be appropriately matched to both teaching and learning activities. Inadequate technology resources cannot meet specific education needs in secondary schools.
2.9 Conclusion

This chapter has explored literature related to secondary school computerisation on the aspects of adequacy and sustainability. From this literature review, very little information is available on the adequacy and sustainability of schools computerisation. No information is available on the same about secondary school computerisation in Kitui County. There is limited literature on the user needs and how the satisfaction of these needs is affected by adequate and sustainable computerisation.
CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter describes the methodology that the researcher used in this study. Specifically, the chapter describes the research design, location of the study, population and sampling procedures, the sample size, research instruments, pilot study, data collection procedures and data analysis.

3.2 Research Design

This study used a descriptive survey approach. Both quantitative and qualitative methods were used in data collection, analyses and reporting. The use of these methods provided in-depth information and description about the basic dynamics of adequacy and sustainability of computerisation in schools. The research population consisted of all provincial secondary schools in Kitui County. They all had computer equipment and being public institutions, they were easily accessible. Data for this research was collected from primary and secondary sources using various methods, which included the questionnaire, interview schedules and observation guides. The field research for the study was conducted in the space of one month. Questionnaires were administered and interviews conducted with key informants at the selected secondary schools in Kitui County. Primary data was collected using questionnaires, interview schedules, observation guides and checklists, while secondary data was obtained from journals, books, and the Internet. The research process is shown in fig. 3.1
Fig. 3.1: Research Design and Process for the study

**Research population:** Provincial Secondary schools in Kitui District

**Sampling:** Purposive sampling and simple random sampling

**Research sample**

**Data collection tools:**
- Questionnaire
- Interview schedule
- Observation guide
- Check list

**Research subjects:** Teachers, head teachers, computer teachers & Form 4 students

**Data Collection**

**Data analysis:**
- Edit and code
- Description and categorization

**Data presentation**
- Themes
- Tables
- Charts

**Summary and conclusion**

**Recommendations**

**Thesis report**
3.3 Location of the Study

This study was carried out in Kitui County, which has many schools with computers. All the schools in the sample have had computers for more than three years. The researcher purposively selected Kitui County because of its many schools that have and use computers. It was also convenient in terms of proximity to the researcher's work station. This advantage translated into efficient administration of the research process.

3.4 Target Population

Kitui has 19 provincial secondary schools with a population of 399 teachers and 9845 students (KDES, 2009). The respondents in this study included teachers of various subjects taught in secondary school, the head teachers of the selected schools and Form Four students.

3.5 The Sample Size and Sampling Procedure

The researcher used both purposive and simple random sampling in this study. From the list of provincial secondary schools in Kitui County, the researcher purposively selected six secondary schools, which formed 30% of the total number of schools. Purposive selection was done so that the researcher could end up with schools that had fully-fledged laboratories. The other guiding principle was accessibility to the schools and student population (at least three streams). The subjects of the study sample were chosen through stratified random sampling. The strata were subject groups, which are Mathematics, Languages, Sciences, Humanities and technical subjects. A sample of teachers was picked, representing all subject groups. Then a thirty percent simple random sample of teachers was randomly chosen from each of the subject groups. The sample size was 120 teachers.
Table 3.1: Sampling Frame for subject teachers

<table>
<thead>
<tr>
<th>Subject Teachers</th>
<th>No. of Teachers</th>
<th>Sample Size (30%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maths</td>
<td>59</td>
<td>18</td>
</tr>
<tr>
<td>Sciences</td>
<td>76</td>
<td>23</td>
</tr>
<tr>
<td>Languages</td>
<td>126</td>
<td>38</td>
</tr>
<tr>
<td>Humanities</td>
<td>72</td>
<td>22</td>
</tr>
<tr>
<td>Technical subjects</td>
<td>66</td>
<td>20</td>
</tr>
<tr>
<td>TOTALS</td>
<td>399</td>
<td>120</td>
</tr>
</tbody>
</table>

Furthermore, all the six head teachers and the six computer teachers of the six schools were purposively included in the sample. Head teachers are central to acquisition, management of learning resources in schools, and are responsible for spearheading formulation and implementation of school policies. Computer teachers have the best understanding of the dynamics concerning computers in schools and were therefore considered to be important respondents to this study.

Finally, a twenty percent random sample of form 4 students was included in the sample, making a total of 163 students. Only form 4 students were included in the study. At form 4, they have been in school the longest and were therefore likely to provide the most valid data.

The sample was small since the scope of the study entailed an in-depth investigation of many indicators on the ground.

3.6 Research instruments

The researcher used the following data collection tools.
3.6.1 Questionnaires for subject Teachers (Appendix I)

This tool contained twenty-seven questions – twenty three of them closed and four of them open-ended. The first six questions inquired into basic information about the respondent while the next twelve questions explored issues about their accessibility of computer equipment and the internet. Five more questions asked for teachers’ comments on adequacy and user-friendliness of computer hardware and software. The last four questions asked about teachers' opinions on computer use for teaching and learning and the needs they would like to see addressed by computer technology in their schools. The data generated by this tool was used to gauge whether school computerization is adequate or not.

3.6.2 Questionnaire for teachers of computer studies (Appendix II).

This questionnaire had fifteen questions, both open-ended and closed type. This tool was also used to supplement the observation schedule by confirming the computer models, software versions, peripherals and serviceability of the computer equipment. Questions 1 to 4 were used to collect basic information about teachers of Computers Studies. Questions 5 to 9 inquired into the status of the hardware, while question 10 documented the available software and their opinion on the adequacy of these in meeting teacher and learner needs. The tool also documented what software teachers felt was needed to make the labs adequate. Question 11 and 12 documented the nature and frequency of service and maintenance and the issue of sustainability of current school computerisation. The last question inquired into their contribution in assisting other teachers’ access and use computers and their opinions on the adequacy of the available computers.
3.6.3 Head teachers' Interview schedule

In-depth semi-structured interviews were conducted with principals of six secondary schools. (Appendix III). This tool had fifteen questions. Four questions dealt with policy issues; five with funding; three questions with staff training, repair and maintenance. The last three questions inquired into how principals facilitate access to and use of computers for teaching and learning. These interviews were used to establish background information on the schools concerned and to gather factual information on how ICT issues are facilitated. Data generated by this tool complimented what was generated by the checklist and document analysis.

3.6.4 Questionnaire for students

This questionnaire was meant to collect information on the students' views on the use and status of computers in their schools (Appendix IV). The tool had five open-ended and five closed questions. Data generated using this tool was used to document learner ICT needs and students' opinions on the adequacy of the available computers in meeting those needs.

3.6.5 Check list for ICT facilities

An observation guide was used to observe some of the ICT facilities available in the schools. (Appendix V). It comprised of nine sections set out in form of tables, with columns containing lists of the items to be checked. These were, ICT policy, recurrent expenditure, and computer accessibility, generation of processors, accessories and peripherals. It was also used to check the kinds of operating system, the versions of application software and availability of e-learning material. This tool generated useful data by confirming the nature of hardware and software available in schools as well as the physical distribution of computers in the schools.
This tool was also used to scrutinize the inventory, maintenance records teaching timetable, school budget, stores ledger and procurement records. These were important in assessing the organizational factors that influence adequacy and sustenance of computer equipment.

3.7 Pilot Study

To test for the validity and reliability of data collection tools, the researcher carried out a pilot study. Validity is the degree to which results obtained from the analysis of the data actually represent the phenomenon under study (Mugenda and Mugenda, 1999). Joppe (2000:1) defines reliability as:

...the extent to which results are consistent over time and an accurate representation of the total population under study is referred to as reliability and if the results of a study can be reproduced under a similar methodology, then the research instrument is considered to be reliable.

To ensure validity and reliability in a qualitative study, Patton (2001) advocates the use of triangulation by stating “triangulation strengthens a study by combining methods. Triangulation is defined to be “a validity procedure where researchers search for convergence among multiple and different sources of information to form themes or categories in a study” (Creswell & Miller, 2000:126) – as cited in Golafshani (2003)

To estimate reliability of the research tools, the researcher used test-retest method. The subject teachers’ questionnaire (appendix 1) and the computer teacher’s questionnaire (appendix 2) were standardised by removing all open-ended questions. The choices given for each closed-type question were assigned numerical values ranging from 1 to five. The questionnaires were then administered and the first set of scores obtained. After three weeks, the same tools were administered again and the second set of scores obtained. Standard deviation and the variance
were calculated for each set of scores. The correlation coefficient was then calculated. Correlation between two observations of the same measure is an estimate of reliability. In this study, the correlation coefficient was calculated using the formula below.

\[
\text{correlation}(X_1, X_2) = \frac{\text{covariance}(X_1, X_2)}{\text{sd}(X_1) \times \text{sd}(X_2)}
\]

Where \(X_1\) is the first set of observed scores while \(X_2\) is the second set of observed scores. 'sd' stands for the standard deviation (which is the square root of the variance).

For the subject teachers’ questionnaire (appendix 1), a correlation coefficient of 0.714 was obtained. For the computer teacher’s questionnaire (appendix 2), a correlation coefficient of 0.824 was obtained. This was taken as high reliability.

Piloting of instruments was done on 2 schools, which were purposively selected. The pilot schools had the same characteristics as those in the sample and were not included in the research sample. Then arising from the pilot study, the instruments were fine-tuned before the actual study.

3.8 Data collection procedure

The researcher acquired a permit from the Ministry of Education to enable him carry out the research in Kitui County. The researcher then visited the schools included in the sample to get acquainted with the schools and inform the administration of the intended study. The researcher then identified the respondents to be included in the sample. Each school, through a prearranged
appointment, was assigned a day for data collection. The researcher spent a day in each of the schools, where questionnaire were distributed to the teachers and students in the study sample. The respondents completed the questionnaires on their own. As questionnaires were getting completed, the researcher conducted face to face interviews with the principal. After the interview, the computer Studies teachers then facilitated completing of the checklist to enable the researcher compile a list of hardware and software available in the said schools. The principal facilitated access to the books of accounts to enable data collection on expenditure on ICT.

3.9 Data analysis

In this survey, most of the data was analysed quantitatively. Raw data was scrutinized for completeness, organized and then coded before being entered into a Microsoft Excel worksheet for analysis. This data was presented using basic percentages in tables, graphs and in pie charts. The computer software, EZ-Text, was used in analyzing the qualitative data generated from responses to open-ended questions. The software was used to quantify the results of this analysis, indicating the frequency of particular responses to each question.

The researcher sought to establish adequacy and sustainability of school computerization by analysing for the following aspects. First, whether the teachers and learners have adequate accessibility to computers and the internet as well as e-learning matter. Second, the researcher assessed the cost of running computerization in schools and the percentage of funding allocated to ICT needs. Third, the ICT teaching and learning needs were documented. Next, the status of computer equipment was analysed. Furthermore, the researcher analysed for administrative
support or lack of it in facilitating ICT issues. Lastly, the researcher analysed for types and
nature of digital e-learning content available in schools.

The analyzed data was presented as detailed descriptions under various relevant themes. Tables,
charts and percentages were also used.

3.10 Logical and Ethical considerations

The following ethical issues were put in consideration:

(i) The principle of voluntary participation: no one was coerced into participating in
research.

(ii) The principle of informed consent. All prospective research participants were fully
informed about the nature of research and risks involved must give their consent to
participate in the research.

(iii) The researcher did not put participants in a situation where they might be at risk of
harm as a result of their participation, whether physical or psychological.
CHAPTER FOUR

DATA ANALYSIS AND INTERPRETATION

4.1 Introduction

The previous chapter gave details about the methodology that was used in this study. This chapter presents data, their analyses and interpretation. The main objective of this survey was to gather data that would help in assessing the adequacy and sustainability of computerization in selected secondary schools in Kitui County. To fulfil this, data was collected from teachers, head teachers and learners using questionnaires, interview schedules, checklists and analysis of relevant documents.

To facilitate analysis and presentation, the raw data was first scrutinized for completeness and quality. This data was then organized into inventories representing each study objective. All quantitative data was summarised in form of tables, bar graphs and pie charts. Descriptive statistics was used to analyse this quantifiable data. Next, the researcher summarized qualitative data by making categories for related responses and coding them. Later, these were entered into compilation sheets and matrices created in MS-Word® and MS-Excel®. The computer software, EZ-Text, was used in analyzing this qualitative data generated from responses to open-ended questions. The software was used to quantify the results of this analysis, indicating the frequency of particular responses to each question. These values were then used to create bar graphs and pie charts.
The researcher analysed the data to establish first, whether school computerization was adequate by looking at physical access to computers and relevant software, access to relevant ICT skills and the internet. The researcher also analysed for adequacy by looking at the generations of computers in use and the versions of software available as well as the availability of relevant digital content in secondary schools. Secondly, the researcher analysed for sustainability of computerisation by looking at the cost of initiating and running schools computerisation and the administrative support needed to keep ICT infrastructure in shape. Thirdly, the researcher analysed for the impact that the status of equipment in secondary schools has on the extent to which ICT learning and teaching needs are catered for.

The analyzed data was presented as detailed descriptions under various relevant themes. Tables, charts and percentages and were also be used. After each section is presented, analysis and interpretation is done and this is followed by a discussion on how particular indicators determine adequacy and sustainability of school computerization.

4.1.1 The sample school population

The researcher studied six schools in Kitui County. All the schools had fully-fledged computer labs and were in a radius of not more than twenty kilometres from Kitui town. These schools included Kyangwithya Boys Secondary school, Kitui School, Mulango Girls School, St. Matheus Mulumba, Matinyani, Yumbisye Mixed and Kyondoni Girls secondary school. Information about the schools contained in the following paragraphs was true as at September, 2010, when the data was collected.
(a) **Kyangwithya Boys Secondary school**

This is a provincial two-stream boy’s secondary school located approximately three kilometres from Kitui town. At the time of this study, September, 2010, it had a student population of 322 and a teacher population of 17. It had a modern computer lab with state-of-the-art Duo-core computers which were all networked. They had been acquired through funding from the Ministry of Education. All offices had computers including the staffroom. The school had no internet connection or a teacher employed by the Teachers Service Commission.

(b) **Kitui School**

This is a four-stream boy’s secondary school located only a kilometre from Kitui town. It is a designated Centre of Excellence in Kitui Central Constituency. At the time of this study September, 2010, the school had a student population of 670 and a teacher population of thirty-six. The computer lab here had 15 computers, all of which were networked. A server in the lab served all computers in the school Local Area Network (LAN). A computer for the teachers is provided in the staff room. All machines were connected to the internet. The school had a teacher employed by the Teachers’ Service Commission.

(c) **AIC Kyondoni Girls**

This is a three-stream girls’ school with a population of 500 students and 20 teachers (as at September, 2010). It is located approximately twenty kilometres from Kitui town. The computers are not networked and neither are they connected to the internet. Apart from the computer room, where there are fifteen computers, only the head teacher’s office has a computer.
(d) Mulango Girls

This is a three-stream girls school located six kilometres from Kitui town. At September, 2010, the school had a student population of 585 and a teacher population of twenty-nine. The school computer lab had 16 computers but only ten of them were functional. The internet connection was only available for administrative purposes. The computers were not networked. There were computers in various offices but there was none in the staffroom.

(e) St. Matheus Mulumba, Matinyani

The three-streamed boys' school is located nine kilometres from Kitui town with a population of six hundred and sixty students and twenty-six teachers (as at September, 2010). The computer lab had eleven computers but only seven were functional at the time of this study. Although there were computers in departmental offices and at the typing pool, networking had not been done and the school did not have an internet connection.

(f) Yumbisye Secondary School

This is a four-stream mixed day secondary school with a population of seven hundred and fifty seven students and thirty-two teachers. The lab had eighteen computers but only ten were functional when this data was being collected. The school’s computers were not networked. There were computers in various offices but none of them was set aside for teachers’ use. The Internet connection was a Safaricom Modem, which was used for teaching computer classes and for administrative purposes.
4.1.2 The Respondents

The study involved teachers and students in the six schools that were surveyed. Teachers of all subjects were targeted regardless of their teaching experience. The learners involved in the study were all in form four at the time data was collected. One hundred and twenty questionnaires were distributed to teachers of various subjects across the six schools. Out of these, eighty of them were returned accounting for 67.5% return rate. In addition, one hundred and sixty questionnaires were distributed to students, 148 of which were dully completed, accounting for 92.5% return rate. Separate questionnaires were distributed to all the six teachers of Computer Studies and all of them were returned. The researcher was able to personally interview all the six head teachers of the selected secondary schools. Moreover, the researcher made a physical check of the computer equipment and analysed for the recurrent expenditure of attributed to the use of computers in secondary schools.

The collected data is presented according to the various indicators that were investigated.

4.2 Access to ICT facilities

4.2.1 Access to computer hardware

The researcher sought to determine accessibility of computer equipment to teachers and learners in terms of physical access to computer hardware, digital content, the Internet and access to ICT literacy skills.

51
4.2.2 Student to Computer ratios

The study surveyed the actual number of computers and weighed them against the student population in each school. Then, the actual student-computer ratio during lessons was calculated. This is shown in Table 4.1

Table 4.1: Student to computer ratio

<table>
<thead>
<tr>
<th>School</th>
<th>School Population</th>
<th>*No. of PC's</th>
<th>Student/Computer Ratio in School</th>
<th>Average Class Size</th>
<th>Actual Ratio During Lesson</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kitui Sch.</td>
<td>670</td>
<td>15</td>
<td>45:1</td>
<td>42</td>
<td>3:1</td>
</tr>
<tr>
<td>Kyangwithya</td>
<td>322</td>
<td>20</td>
<td>17:1</td>
<td>41</td>
<td>2:1</td>
</tr>
<tr>
<td>Kyondoni</td>
<td>500</td>
<td>15</td>
<td>34:1</td>
<td>42</td>
<td>3:1</td>
</tr>
<tr>
<td>Matinyani</td>
<td>660</td>
<td>7</td>
<td>95:1</td>
<td>55</td>
<td>8:1</td>
</tr>
<tr>
<td>Mulango</td>
<td>585</td>
<td>10</td>
<td>59:1</td>
<td>49</td>
<td>5:1</td>
</tr>
<tr>
<td>Yumbisye</td>
<td>757</td>
<td>10</td>
<td>76:1</td>
<td>47</td>
<td>5:1</td>
</tr>
</tbody>
</table>

*The number of PC's in this table refers to computers available for students’ use.

The recommended student-computer ratio is one computer for every 50 students (The National ICT strategy for Education and Training, 2006). However, three out of six schools surveyed had a ratio higher than this. The worst-case scenario is having 95 students for every computer. No effective teaching can take place. This compromises the attempt to achieve basic IT literacy among the majority of students. Only Kyangwithya secondary school, whose computerisation was funded by the Ministry of Education, has achieved the desired ratio.

This is clearly not adequate. Computer Studies teachers in the survey complained that some students only followed the lessons without any opportunity to operate the machines. One
computer teacher said that ‘while one student operates the machine, six others are spectators’. They reported that this led to difficulties in achieving desired learning outcomes.

Inadequate computer numbers means that access is severely hampered. In one school, students reported that that the school administration did not allow them time to access the computer lab outside the teaching timetable. In another, the computer teacher is only available during the computer lesson, leaving students with no time to practice what they have learnt.

### 4.2.3 Distribution of computers in schools

The physical location of computers in the said schools was also looked at. The researcher was of the view that the more locations computers are availed, the more accessible they are to the users.

**Table 4.2: Percentage distribution of computers in selected schools**

<table>
<thead>
<tr>
<th>Locations</th>
<th>Kya(n = 26)</th>
<th>Kit(n = 20)</th>
<th>Yum(n = 14)</th>
<th>Mula(n = 12)</th>
<th>Mat(n = 12)</th>
<th>Kyo(n = 17)</th>
</tr>
</thead>
<tbody>
<tr>
<td>The laboratory</td>
<td>77%</td>
<td>75%</td>
<td>75%</td>
<td>83%</td>
<td>58%</td>
<td>88%</td>
</tr>
<tr>
<td>Principal’s office</td>
<td>0%</td>
<td>5%</td>
<td>5%</td>
<td>0%</td>
<td>0%</td>
<td>6%</td>
</tr>
<tr>
<td>Departmental offices</td>
<td>7%</td>
<td>0%</td>
<td>10%</td>
<td>0%</td>
<td>25%</td>
<td>0%</td>
</tr>
<tr>
<td>Typing pool/reception</td>
<td>8%</td>
<td>10%</td>
<td>5%</td>
<td>9%</td>
<td>17%</td>
<td>6%</td>
</tr>
<tr>
<td>Accounts office</td>
<td>4%</td>
<td>5%</td>
<td>5%</td>
<td>8%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Staffroom</td>
<td>4%</td>
<td>5%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Total</td>
<td>100.00%</td>
<td>100.00%</td>
<td>100.00%</td>
<td>100.00%</td>
<td>100.00%</td>
<td>100.00%</td>
</tr>
</tbody>
</table>

*The (n) is the total number of all computers in a school.*
Table 4.2 indicates that computers for teachers are not a priority. Only two schools have a computer in the staffroom for teachers' use and these account for less than 5% of the total machines found in these schools. This result agrees with Wims and Lawler (2007) who observed that there were no computers set aside for teachers. Three of the schools had computers in Examinations Department offices, mainly for the storing and analysis of students' marks. From this table, it is clear that most of the computers, as expected are in the computer labs. The researcher therefore sought to find out whether the computer laboratories are accessible to teachers. Data gathered from computer teachers in these schools revealed that the lab in a typical three-stream school is free of Computer Studies lessons at least six hours out of thirty hours in a forty-five lessons week. This is enough time that can be used by teachers and learners to meet educational needs. However, when asked to specify where they access computers for their own use, only 17% of teachers indicated as having used these hours to utilise these computers. This is shown in Figure 4.1

Fig 4.1: Locations Where Teachers Access Computers for their Use
This pie chart also reveals that 52% of teachers do not use computers at all in their schools. Although the labs in these schools are free for use by teachers, many of the teachers do not make use of this resource. This brings up the question of access to requisite IT skills to enable them use computers. There is also the question of lack of interest as confirmed in this study. The data collected indicated that schools acquired new technology without planning to institute staff development to match the new technology. Computer illiteracy is confirmed in fig 4.2.

Another dimension that came up is that of owning computers. Only three percent of teachers reported owning either a laptop or a desktop computer. Teachers therefore do not consider it a priority to own a computer. The researcher also sought to know why some teachers did not use computers in school. The responses collected are presented in Figure 4.2.

Fig. 4.2: Reasons advanced by teachers to explain why they do not use computers in school.
The graph reveals that 39% of teachers are either semiliterate or not literate at all. Sixteen percent reported having no interest in using computers. It is interesting to note that these two groups total to 55%, which is comparable to the 52% who admitted not using computers in Fig 4.1. Another nineteen percent complained of lack of access while six percent cited administrative obstacles as a reason. Teachers indicated that they would use computers if the machines were availed in the staffroom. They complained that the nature of their work does not allow sharing computers with their students since some of their work is confidential. They stressed the importance of setting aside computers for teachers. In addition, some said they would like to learn to use the computers but would find it embarrassing to learn it in the lab just as their students.

### 4.3 Access to the Internet

In this study, there was need to assess the teachers’ access to the Internet since this is an important source of digital content that could be used for teaching and learning. The study revealed that only three schools had access to the Internet as reflected by Table 4.3

#### Table 4.3: The Means to Internet Access

<table>
<thead>
<tr>
<th>SCHOOL</th>
<th>TYPE of connection</th>
<th>No. of connected Computers</th>
<th>Availability of LAN</th>
<th>Is connection adequate?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kitui School</td>
<td>LEASED LINE</td>
<td>19</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Yumbisye</td>
<td>3G MOBILE</td>
<td>2</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>Mulango</td>
<td>3G MOBILE</td>
<td>1</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>Kyangwithya</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>NO</td>
</tr>
<tr>
<td>Kyondo</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>NO</td>
</tr>
<tr>
<td>Matinyani</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>NO</td>
</tr>
</tbody>
</table>
Table 4.3 indicates that although three schools have access to the Internet, only users in one school consider the connection adequate. Data collected revealed that only in Kitui School internet is available to both teachers and learners. The school was connected to an ‘Always on’ Orange® CDMA wireless. All the machines are networked and all are connected to a server in the computer lab. There is one computer in the staffroom where the staff can access the net freely. Students access the net from the lab during their free time as long as the computer teacher is available to monitor their activities. Mulango Girls and Yumbisye Secondary schools use GPRS Safaricom modems but the use is limited to teaching of IT and official administrative communication. Teachers who would like to use it have to load their own airtime credit. The other schools do not have any form of internet connection. This finding concurs with the finding Oloo (2009), where 58.9% of schools were found without an internet connection.

Since the internet is an integral part of modern life, the study sought to find out how teachers generally access the net in the absence of such services being provided in school. The responses are presented in Figure 4.3.
This figure reveals that the mobile phone is by far the most popular means (36%) of accessing the Internet. However, this means is limited since there are many file formats that a standard mobile phone cannot access. Another 24% reported visiting the cyber café for Internet services. Only 5% access the net using their own computers. Finally, there are some 35% of teachers who are not internet-literate and therefore have no access at all to this vital resource.

4.3.1 Reasons why teachers access the Internet

Although the percentage of teachers accessing the net is small, the researcher sought to find out why they access the Internet. This was meant to determine whether they used the net for educational purposes. The results are presented in Figure 4.4.
The above figure shows that only 24% of teachers who access the internet do so to search for educational content. Thirty-three percent use it to send email while 43% use it for fun on social networking sites. This means that where Internet service is available, it is severely underutilized. Teachers are yet to appreciate the Internet as a source of educational content.

4.4 The Cost of computerization and rationale of Introducing Computers

In this study, it was necessary to determine the cost of computerization in schools. This involved looking at both the fixed costs and recurrent expenditure on an annual basis. The researcher sought to find out the sources of funding of the projects and the rationale of introducing computers to school. Also, recurrent expenditure was computed and was then weighed against the available funds to determine whether the use of computers was sustainable.
4.4.1 Means by Which Institutions Acquired Computers

This study also documented the genesis of computerization in individual school. The overriding objectives for establishing computer labs were also investigated.

Table 4.4: Ways by Which Institutions acquired computers

<table>
<thead>
<tr>
<th>SCHOOL</th>
<th>Ways by Which Institutions acquired computers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yumbisye</td>
<td>Donation from NGO's /purchasing</td>
</tr>
<tr>
<td>Kyondoni</td>
<td>Donation from NGO's</td>
</tr>
<tr>
<td>Mulango</td>
<td>Purchasing</td>
</tr>
<tr>
<td>Kyangwithya</td>
<td>Ministry of Education</td>
</tr>
<tr>
<td>Matinyani</td>
<td>Donation from NGO's /purchasing</td>
</tr>
<tr>
<td>Kitui school</td>
<td>Purchasing</td>
</tr>
</tbody>
</table>

The table indicates that 50% of the schools relied on donations from NGO’s to introduce computers in their schools. This result is similar to the finding of Oloo (2009) where majority of the schools were found with computers from donors or from the government. Head teachers interviewed reported that donated computers were not useful. In some cases, computer donations were channelled through organisations that demanded demurrage and shipping charges, making the supposed donations more expensive than they should have been. The researcher observed that many of the donated computers were old and formed part of the unserviceable lot lying in these schools. Those who purchased used funds provided by parents in the name of development funds. Only one school reported having received assistance from the Ministry of Education.

On the subject of the objectives for establishing a computer lab, all the head teachers admitted that they wanted their schools to look modern. The idea was to impart IT literacy skills on the students. However, no school had measures in place to ensure all learners who didn’t opt to study
Computer Studies up to form four left school with requisite ICT skills. On the same note, none had the objective of using the IT technology in teaching and learning. Therefore, the subject of having computers that are adequate to serve instructional needs did not arise when computers were introduced. In Kyangwithya Secondary School, where there was considerable amount of digital content, no teacher except the Computer Studies teacher reported having used the same for teaching and learning. This means that there was no attempt to assess the specific ICT needs in the said institutions before computerization was initiated.

Looking at fixed and recurrent expenditure is one way of determining Total Cost of Ownership (TCO). The fixed cost includes the initial cost of setting up the lab. This comprises the construction expenses, furniture and fittings, cabling and the purchase of computers as well as the initial cost of program installation. In two schools (Kitui and Mulango), the labs were established in existing buildings and therefore lab construction did not form part of fixed expenses. In the other schools, the labs had been constructed more than three years earlier and therefore their cost did not feature in the school accounts of the year 2010.

On the other hand, the recurrent expenditure comprises purchases of consumables, software license fees and the cost of repair and maintenance. In two out of six schools, the computer teacher was employed by the board and therefore their salaries formed part of the recurrent expenditure.

4.4.2 Repairs and Maintenance

The head teachers interviewed indicated that they used money from Repairs Maintenance and Improvement (RMI) account to keep the lab running. The study tried to determine the proportion of RMI funds that goes towards repairs and maintenance.
Table 4.5: Repairs and Maintenance Expenditure

<table>
<thead>
<tr>
<th>School</th>
<th>Amount of money in Annual RMI Vote head in K.shs</th>
<th>Amount spent in year 2010 in K.shs</th>
<th>Percentage proportion of this cost to the annual RMI Allocation</th>
</tr>
</thead>
<tbody>
<tr>
<td>KITUI SCH.</td>
<td>268000</td>
<td>54000</td>
<td>10.1</td>
</tr>
<tr>
<td>KYANGWITHYA</td>
<td>128800</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>KYONDONI</td>
<td>200000</td>
<td>10000</td>
<td>5</td>
</tr>
<tr>
<td>MATINYANI</td>
<td>264000</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>MULANGO</td>
<td>234000</td>
<td>15000</td>
<td>6.4</td>
</tr>
<tr>
<td>YUMBISYE</td>
<td>302800</td>
<td>18000</td>
<td>5.9</td>
</tr>
</tbody>
</table>

In this table, two schools reported that they had incurred no cost in maintenance in the year 2010. Kitui School’s expenses were higher owing to network administration and the internet charges. Kitui School engages the Computer Studies teacher to carry out maintenance. Therefore, this cost could have been higher if the school had contracted a private firm. In the rest three schools, their expenses ranged from five to six Percent of the total RMI allocation of the respective schools. This is a paltry sum, which cannot be expected to keep the computers in top condition.

4.4.3 The Cost of Consumables

This study found out that in the absence of an IT vote head, schools use funds from tuition account to pay for consumables such as ink cartridges and printing papers. This is computed in the following table.
Table 4.6: The cost of ICT Consumables

<table>
<thead>
<tr>
<th>School</th>
<th>Amount of money in annual Tuition Vote head in Kshs</th>
<th>Amount spent in year 2010 in Kshs</th>
<th>Percentage proportion of this cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>KITUI SCH.</td>
<td>2412000</td>
<td>214000</td>
<td>8.8</td>
</tr>
<tr>
<td>KYANGWITHYA</td>
<td>1159200</td>
<td>70500</td>
<td>6.1</td>
</tr>
<tr>
<td>KYONDONI</td>
<td>1800000</td>
<td>112000</td>
<td>6.2</td>
</tr>
<tr>
<td>MATINYANI</td>
<td>2376000</td>
<td>129000</td>
<td>5.4</td>
</tr>
<tr>
<td>MULANGO</td>
<td>2106000</td>
<td>132000</td>
<td>6.2</td>
</tr>
<tr>
<td>YUMBISYE</td>
<td>2725200</td>
<td>180000</td>
<td>6.6</td>
</tr>
</tbody>
</table>

The table indicates that the amount used from tuition vote account ranged from five percent to nine percent. Teachers of Computer Studies complained that this amount was too little to sustain the various needs. This finding concurs with Olo (2009) in baseline survey of Kenyan schools, where he reports that schools felt that they did not have adequate funding to purchase ICT equipment. In interviews with two out of six head teachers, it was noted that improving ICT equipment in their schools was not a priority.

4.4.4 Salaries for Teaching Staff

Although the Teachers Service Commission is expected to provide computer teachers to schools, three out of the six schools have teachers employed by the Boards of Governors. The head teachers reported that they utilise funds from Personal Emoluments (PE) account to remunerate teachers.
Table 4.7: Salaries for Teaching Staff

<table>
<thead>
<tr>
<th>SCHOOL</th>
<th>Amount of money in Annual P. E. Vote head in K.shs</th>
<th>Amount spent in year 2010 in K.shs</th>
<th>Percentage proportion of this cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>KYANGWITHYA</td>
<td>1271900</td>
<td>144000</td>
<td>11.3</td>
</tr>
<tr>
<td>MULANGO</td>
<td>2310750</td>
<td>144000</td>
<td>6.2</td>
</tr>
<tr>
<td>KYONDONI</td>
<td>1975000</td>
<td>156000</td>
<td>7.9</td>
</tr>
</tbody>
</table>

This table indicates that schools with low enrolment use a bigger portion of their P. E. funds to pay salaries for Computer Studies teacher. The PE funds are meant to pay salaries to all non-teaching staff in the school. The administrators reported that using money from this account to pay a teacher places undue constrain on the school accounts. One head teacher said that they have to borrow from other vote heads to meet staff salary obligations. This is against official accounting procedures.

This data was obtained through self-reporting by head teachers and through examining books of accounts.

4.5 Teachers’ and Students’ Teaching and Learning Needs

The study sought to determine the ICT teaching and learning needs of teachers and students in secondary schools. Forty-eight percent (n=80) of teachers interested in using computers outlined what they would like to do with computers in the course of their teaching. These specific needs are outlined below:

- They would like to conduct PowerPoint presentations in the classroom.
- They would like to use word processors in preparing teaching records and lesson notes
- Setting examination papers and continuous assessment tests
• Preparing and storing students’ database for easy retrieval and management

• Analyzing students’ marks and managing progress records

• Using the Internet in searching for educational content.

• Using e-learning materials in various subjects

• Using dictionaries and thesaurus in language lessons

The fact that teachers and learners are aware of their IT needs means that they are able to assess whether the available computers are adequate in meeting those needs.

Though 60% of the teacher respondents would like to use presentations in their classes, only one of the school surveyed had a digital projector. In this school, only two teachers reported having used it in class. Another sixty-one percent of teachers reported they would like to use the internet to supplement their teaching notes, but this is severely hampered by administrative huddles. All these needs specified require unlimited access to computers and this is clearly not afforded since only two schools had a computer set aside for exclusive use by teachers. The need to have subject-specific e-learning content was expressed by 35% of the respondents but this is severely hampered by limited availability of digital content in schools. The IT resources available in these schools are therefore not adequate to serve the needs of the teachers. When the teachers were asked to specify what they would like to see done to improve their use of IT resources, their concerns were very particular, as reflected in Figure 4.5
The above pie chart reveals that the greatest problem in schools is lack of access to ICT resources. Thirty-eight percent of respondents indicated that improving access by providing more computers would encourage more teachers to use them. Another 31% requested for better software while some 6% specifically indicated that schools should source for e-learning content. Twenty-two percent reported they would like to see teachers retrained on how to use computers. However, a considerable number of respondents (13%) did not indicate what they would like to see done, an indication of lack of awareness. When asked who should spearhead retraining of teachers, 47% said the ministry of education should do it while 27% felt it should be a personal initiative. Ten percent indicated that the school administration should be the one to do it. Some 16% claimed that teachers should not bother using computers. This is reflected Table 4.8
Table 4.8: Teachers' Opinion on how they should acquire ICT skills

<table>
<thead>
<tr>
<th>Categories</th>
<th>Percentage responses (n=80)</th>
</tr>
</thead>
<tbody>
<tr>
<td>It is a personal initiative</td>
<td>27%</td>
</tr>
<tr>
<td>The Ministry of education to conduct courses</td>
<td>47%</td>
</tr>
<tr>
<td>The BoG/school administration to sponsor ICT courses</td>
<td>10%</td>
</tr>
<tr>
<td>Teachers need not use computers in their work</td>
<td>16%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
</tr>
</tbody>
</table>

4.5.1 The Needs of Learners

 Majority of students (89%) who completed the questionnaires indicated awareness of the immense possibilities ICT can afford them in and out of school. Seventy-eight percent indicated that they would like to see teachers using IT to teach various subjects. Another 75% said they would like to gain skills that would enable them research on the Internet and even be able to type projects. Thirty percent felt that they could use the Internet to download subject content, and share with students from various schools on club matters and youth advocacy. The learners displayed awareness on e-learning and expressed the need to be provided with digital content in various subjects. They also indicated that they could use the internet to research on their referred careers and the colleges that would be appropriate to join so as to realise those career goals.

When asked what they would like the administration to do to improve IT use, a large number (86%) indicated that they would like to have more modern machines and up-to-date software. Fifty nine percent wished to have unlimited internet access while sixty-three percent indicated...
that they would like the schools to employ a computer lab technician, who would man the lab in the same way science lab assistants do.

4.6 The Status of Computer Equipment in Schools

The study found out that to a certain extent, schools were not doing well in ensuring the computers remained serviceable. A chart showing the number of serviceable against unserviceable computers is presented in Figure 4.6

**Fig. 4.6: Functional and broken down computers**

<table>
<thead>
<tr>
<th>School</th>
<th>Functional (%)</th>
<th>Broken (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>KYONDONI (n=15)</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>MATINYANI (n=7)</td>
<td>37%</td>
<td>63%</td>
</tr>
<tr>
<td>MULANGO (n=10)</td>
<td>38%</td>
<td>63%</td>
</tr>
<tr>
<td>KYANGWITHYA (n=20)</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>YUMBISYE (n=10)</td>
<td>40%</td>
<td>60%</td>
</tr>
<tr>
<td>KITUI SCH (n=15)</td>
<td>0%</td>
<td>100%</td>
</tr>
</tbody>
</table>

In three out of the six schools surveyed, 100% of computers were functional. In Kyangwithya Secondary School, the computers were less than two years old while in Kitui School and
Kyondoni, the computer teachers reported that their head teachers were computer-literate and provided all the necessary support to keep the machines running. The other three schools had various difficulties in running the computer labs. The head teachers of these exhibited little knowledge in ICT during face-to-face interviews. In Matinyani Boys, 63 percent of the machines were broken down; while in Yumbisye, 40% of the machines were broken down. The other school, Mulango, had 38 percent of their machines down.

With this kind of scenario, computer teachers are constrained in providing quality and adequate instruction to their students. In addition, teachers of other subjects who would like to utilise the machines to meet their instructional needs will find this situation untenable.

4.6.1 The Generation of Computers

This study documented the kind of processors in use in schools. The newer the machines, the faster they are. Newer machines are able handle complex tasks and can run newer programmes and are therefore suitable in meeting teaching and learning needs. Figure 4.7 shows the types of processors available in secondary schools.
The chart reveals that twelve percent of machines in schools are of the 486 generation. These machines were last manufactured in 1995, sixteen years ago. Some 20% comprises Pentium 1 and 2 processors manufactured between 1996 and 1998. These machines are extremely slow, with very limited system resources and cannot run contemporary programs. Pentium 3 only accounted for 8% while the more modern Pentium 4 and Duo Core accounted for 40% and 20% respectively. The Duo-core processors, which were the fastest machines observed in the survey were all found in the same school – Kyangwithya Secondary School.

This is not adequate if schools hope to keep in step with the constantly changing ICT trends, which demand state-of-the-art computer technology.
4.6.2 Computer Accessories

The study found that peripherals were either nonexistent or inadequate in the computer labs. Several important devices were missing.

Table 4.9: Installed Computer Devices

<table>
<thead>
<tr>
<th>Device type</th>
<th>MUL n=10</th>
<th>KYA n=20</th>
<th>YUM n=10</th>
<th>KYO n=15</th>
<th>KIT n=15</th>
<th>MAT n=7</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>CD/DVD Rom</td>
<td>9</td>
<td>20</td>
<td>5</td>
<td>15</td>
<td>0</td>
<td>3</td>
<td>52</td>
</tr>
<tr>
<td>CD/DVD R/RW</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>4</td>
<td>26</td>
</tr>
<tr>
<td>Modem</td>
<td>1</td>
<td>20</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>4</td>
<td>41</td>
</tr>
<tr>
<td>USB port</td>
<td>10</td>
<td>20</td>
<td>10</td>
<td>15</td>
<td>16</td>
<td>7</td>
<td>78</td>
</tr>
<tr>
<td>Speakers/sound card</td>
<td>10</td>
<td>20</td>
<td>0</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>37</td>
</tr>
<tr>
<td>Network card</td>
<td>0</td>
<td>20</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>20</td>
</tr>
</tbody>
</table>

This table reveals that most computers are fitted with the basic devices. However, only in Kyangwithya where we have all computers fitted with CD/DVD writers. In Matinyani, four computers are fitted with a CD writer while in Kitui School and Mulango Girls, one computer was fitted with a DVD writer. It is not clear what the other schools do during KCSE Computer Studies examination since it is a requirement to save projects and other practical work on compact disc. With the exception of Kyangwithya secondary school, the devices are therefore not adequate.

The researcher also did a physical check of the peripherals available in schools. This is presented in table 4.5.
<table>
<thead>
<tr>
<th>Device Type</th>
<th>How many Available?</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mul</td>
<td>Kya</td>
<td>Yum</td>
<td>Kyo</td>
<td>Kit</td>
<td>Mat</td>
<td>Mul</td>
<td>Kya</td>
<td>Yum</td>
<td>Kyo</td>
<td>Kit</td>
<td>Mat</td>
</tr>
<tr>
<td>Inkjet Printers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laser printer</td>
<td></td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scanner</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Digital projector</td>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Digital camera</td>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interactive white boards</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>UPS</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>6</td>
<td>0</td>
<td>6</td>
<td>2</td>
<td>18</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>1</td>
</tr>
</tbody>
</table>

This table reveals that the necessary peripherals are not adequate for teachers and learners to meet their needs. At least one school did not have any peripherals in the lab. No school had a digital camera or a smart board. Only one school had a digital projector and three schools had a scanner. Printers are the common peripheral devices in schools. Lack of UPS (Uninterruptible Power Supply) guarantees loss of crucial data during power surges or blackouts. In one school, only two UPS’s were available while in another, only one UPS was available. In Kitui School there were enough units in the computer lab.
1.6.3 Software

In this study, it was necessary to document the kind of software so as to gauge the novelty of computerization in secondary schools in Kitui County. The researcher did a physical check of the Operating Systems in use and specific application programmes. The presence of e-learning content was also determined.

All schools were using Windows® XP, Service pack 2, an operating system released in 2002, eight years ago. Since then there has been Windows®. Vista released in 2007 and Windows®7 released in 2009. In one school (Kyondoni) Windows® 98 operating system was installed on their Pentium 1 and 2 computers.

Only one school had original Windows XP discs. The others had copies chiefly sourced by the computer teacher. Four out of the six schools surveyed reported using Microsoft Office® suite of programmes (Word, Excel, etc) 2003 exclusively. Only two schools reported using the more recent and friendlier Microsoft Office 2007. One school still had Microsoft Office 2000 installed in some computers. Apart from Microsoft Office, two schools reported having other application software. These are PageMaker 7.0 (Desktop publishing) Adobe Acrobat Reader for reading Pocket Document files (PDF). The only educational software evident was found in two schools. Kyangwithya had Cyber School Technology, Lesson Management System and KCSE Version 1. The school also had Microsoft Student Encarta 2008 DVD and Learning Essentials for students - Microsoft Office, Student Edition 2006. Kitui School had a typing tutor, a science program called Eureka and a copy of e-curriculum. It also had a School Management System with tools for examination results analysis and management of students' progress records. Kyondoni Girls and Yumbisye had Microsoft Encarta Premium DVD 2007.
The bulk of the software is not tailored to meet specific e-learning needs. This software situation is not adequate for teaching and learning. Without subject-specific software, teachers cannot benefit from these computers.

4.6.4 Teachers’ Comments on Adequacy and User-friendliness of Computers

The study found out that teachers consider available computers inadequate and indicated that they cannot term them user-friendly. This is illustrated in the table 4.12

Table 4.11: Teachers’ comments on the adequacy of computer equipment

<table>
<thead>
<tr>
<th></th>
<th>Number of computers available</th>
<th>Software/programs installed</th>
<th>Models of available computers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adequate</td>
<td>38%</td>
<td>38%</td>
<td>39%</td>
</tr>
<tr>
<td>Inadequate</td>
<td>62%</td>
<td>62%</td>
<td>61%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Fifty-three percent of teachers who use computers felt that the available equipment was inadequate in terms of the numbers available and the type of software installed in these machines. This is reinforced by the fact teachers specified that they would like to have more computers and easy-to-use e-learning content. Another 61% felt that the computer models available were either inadequate or very inadequate. Those who said that they considered computers in their schools very adequate comprised less than ten percent.
4.6.5 Teachers' Comments on the User-Friendliness of Computer Equipment

In this study, the researcher also realised that the teachers did not find the computers in their schools easy to use. When teachers were asked to specify why they found it difficult to use the available computers, they brought up the following issues as shown in Figure 4.8.

**Fig. 4.8: Teachers' views on why computers are not easy to use**

This chart reveals teachers are aware of what constitutes user-friendliness of computer equipment. Thirty-one percent of teachers felt that inadequate numbers made it difficult to use them. Some 28% indicated that they found them difficult to use because of obsolete hardware and software. Thirteen percent said lack of internet connection made it difficult to access useful material from the net. Another 9% reported that lack of appropriate peripheral devices such as scanners and printers made it difficult to use available computers especially when they want to
produce documents for class use. This data reveals that the question of access to sufficient number of useable machines is a major hindrance to using computers in schools.

4.7 Organizational Factors that determine adequacy and sustainability

The researcher looked at the administrative factors that ensure continued sustenance of school computerization. This study determined that the efforts of school administration in facilitating acquisition of computers, access to the equipment and encouraging taking up of ICT skills influences use or non-use of computers in teaching and learning.

4.7.1 The ICT policy

Policy refers to course of action or a programme of actions adopted by a person, group, or government, or the set of principles on which they are based (Microsoft® Encarta Dictionary Tools® 2006). Keeping within this narrow definition, then what passes as IT policy in schools is grossly inadequate. None of the schools surveyed had a policy requiring all teachers to be IT literate. This concurs with the finding of Ofsted (2005), where he asserts that in England few schools had a strategic plan that saw ICT as a tool for raising standards. Lack of a policy means that only those teachers who have the interest use the computers. In all schools, IT literacy is taught to all students in forms one and two. In forms three and four, only those who opted to study Computer Studies as KCSE examination subject continued attending computer classes. Eighty-five percent of students surveyed reported that they did not take computer lessons seriously in school since they would not be tested at KCSE examination.
Out of the six head teachers interviewed, only two were computer-literate. Administrators who take up new skills are likely to foster development of the same among the members of staff and students.

4.7.2 Facilitating Computer use
From the interviews conducted, it is clear that the school administration has not facilitated the use of computers by facilitating retraining and by providing the hardware and software for teachers’ use. Provision of computers and their peripheral devices to teachers in the staffroom and in their department offices would act as an incentive to utilising them. The study revealed that school administrators have not made it a requirement for teachers to use computers even in doing menial tasks such as preparation of lesson notes. The head teachers did not see the distribution of computers in the school as a crucial variable that determines access to computers or lack of it. With only two schools with a computer in the staffroom, the study found out that the school administration has not deliberately tried to make ICT resources available to a majority of teachers. The researcher found that the machines in Hod’s offices were mainly used to manage examination results and to a limited extent typing and preparation of examination papers and tests by interested teachers.

4.7.3. Funding IT Costs
The school’s official government-prescribed accounting system does not provide for ICT vote head. The head teachers interviewed reported that ICT-related costs were paid from tuition account. Only one school reported that 1500 shillings were levied on Form one students upon reporting. However, this fee was disguised as development levy. Two out of six schools had employed teachers to teach Computer Studies and were paying them from Personal Emoluments
account. All the six school principals interviewed concurred that the schools lacked enough funds to effectively sustain the productive use of ICT resources. This explains why this study found the status of computerization inadequate to meet teaching and learning needs.

4.7.4 Repair and maintenance

This is an important variable since it ensures continued use of the ICT resources. The researcher found out that none of the schools had employed a computer lab technician to take care of routine maintenance and repairs. In this study the repairs and maintenance arrangements that schools have put in place were documented in Table 4.12.

Table 4.12: Repair and Maintenance arrangements in various schools

<table>
<thead>
<tr>
<th>SCHOOL</th>
<th>No. of Computers (n)</th>
<th>Repair and maintenance arrangements</th>
<th>Frequency</th>
<th>Percentage of functional computers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yumbisye</td>
<td>10</td>
<td>Contracted firm</td>
<td>Once a term</td>
<td>60%</td>
</tr>
<tr>
<td>Kyondoni</td>
<td>15</td>
<td>Computer teacher carries out maintenance</td>
<td>No regular schedule</td>
<td>100%</td>
</tr>
<tr>
<td>Mulango</td>
<td>10</td>
<td>Contracted firm</td>
<td>Once a term</td>
<td>63%</td>
</tr>
<tr>
<td>Kyangwithya</td>
<td>20</td>
<td>Nothing in place</td>
<td>No regular schedule</td>
<td>100%</td>
</tr>
<tr>
<td>Matinyani</td>
<td>7</td>
<td>Ad hoc – no regular servicing personnel</td>
<td>No regular schedule</td>
<td>37%</td>
</tr>
<tr>
<td>Kitui school</td>
<td>15</td>
<td>Computer studies teacher</td>
<td>No regular schedule</td>
<td>100%</td>
</tr>
</tbody>
</table>

In Kyangwithya Secondary School, the lab and the machines were very new. The school administration had not found it necessary to put in place repair and maintenance arrangements. In schools where the computer teacher was charged with repair and maintenance, all computers
were found working. In schools with contractual arrangements (Mulango and Yumbisye), about two-thirds of the computers were functional. In Matinyani, where there were no regular servicing personnel, only 37% of computers were working. No school had a dedicated computer technician.

The study established that all schools had a computer inventory managed from stores by the storekeeper. However, only one of the schools had a repair and maintenance record for their computers. In this particular school, the teacher doubled up as the technician.

4.7.5 Staff Training

All head teachers reported that they had made no arrangements to equip the teachers with ICT skills although they admitted that the requisite skills can enhance teaching and learning. They were of the view that the Ministry of Education should spearhead such a venture. This view was shared by a majority of the teachers.

On the same note, this study confirmed whether the teachers of Computer Studies are qualified to teach. The study found out that schools in Kitui have qualified staff to teach Computer Studies. The study found that 50% of the teachers are degree holders while the others are diploma holders. This is the minimum qualification for one to teach in secondary school. The personnel qualification is therefore adequate.

4.7.6 Management of e-waste

Arising from donations of old computers, which become obsolete in a short time, head teachers reported that they find themselves with machines that are not serviceable. In spite of this, the
study found no arrangements on how to dispose of computers or peripheral devices that were no longer needed. The researcher noted that in these schools, unserviceable machines were dumped at a corner in the computer lab or stored them in a room. In one school, old machines were stacked somewhere at a corridor in the administration block. None of the head teachers was aware of the existence of agencies such as Computer for Schools, Kenya, which can help in e-waste management.

4.8 Types of Instructional resources available

For schools to use ICTs successfully in teaching and learning, resources that are specifically tailored to aid instruction should be provided. There is a whole range of hardware and software available in schools that are not meant to meet specific learning needs. This section looks at the digital content available in schools.

4.8.1 Availability of digital content on CD/DVD’s in schools

The study also sought to document the availability of digital educational content in schools. From the data collected from teachers, only 19% reported having come across digital content in their schools. Most of the available content was in form of CDs and DVDs and were in sciences and mathematics. A physical check revealed that much of the content purchased for academic purposes were compilations of revision material and sample KCSE examination papers. This is shown in Figure 4.9
This figure shows that only 22% of available digital material is of e-learning. The rest (78%) is just sample examination papers. Although Kenya Institute of Education has produced digital content for forms one and two, none of the schools had acquired any. This means secondary schools lack the necessary e-learning content for instructional use.

4.9 Supplementary Findings

Many teachers are uncomfortable when asked to reveal their level of IT literacy. Questions asking for such were avoided by eight respondents. Three head teachers though claimed to be IT-literate could not confirm so during the interviews. Their lack of IT skills was evident during the face-to-face interview since they could not use basic IT terminology.
In schools with IT-literate head teachers, the percentage of running computers was high. In these schools, Computer Studies teacher reported being satisfied with the attention given to IT issues by the school administration.

Although the question of sustainability is key to establishing what ails school computerization, this study was not able to reveal part played by the attitude of school administrators.

Several challenges facing school computerization were documented. These included lack of adequate funds to modernise the existing systems. Requisite knowledge on how computers can be integrated in teaching was lacking too. This is why there is lack of positive attitude among the teaching staff towards the use of IT in teaching and learning.

The computer is used as an administrative tool. All schools were using computers in executing basic tasks such as word processing and storage and retrieval of examination data and students’ records. None of the schools was using computers in production of students’ progress records.

The Kenya Institute of education has produced E-learning content for forms one and two. However this study found that forty percent of the DVD’s were out of stock. Also, the content is not available in any other bookshop apart from the KIE bookshop in the institute’s premises on Murang’a Road, Nairobi. This explains why this resource is non-existent in schools.

1.10 Chapter Summary

This chapter has presented findings and interpretation. The section has brought out a number of key issues in secondary school computerization. First, the nature of access to ICT resources was
not adequate to foster use of computers in teaching and learning. Several obstacles to optimum access to ICT resources were identified. These include:

a) Unfavourable student-computer ratio

b) Obsolete hardware and hardware not suited to meet instructional needs.

c) Poor physical distribution of computers in schools.

d) Lack the necessary ICT literacy skills among teachers and administrative support.

e) Lack of access to digital content and the Internet.

f) Poor maintenance and repair of computers and their peripherals in school.

Second, schools are not able to initiate computerization without outside help and cannot adequately sustain it financially. Thirdly, the study found no evidence of teachers’ integration of ICT in teaching and learning. Lastly, the school administration has done little in ensuring that computerization in schools is adequate and sustainable.
CHAPTER FIVE

CONCLUSION, RECOMMENDATIONS AND SUGGESTIONS FOR FURTHER RESEARCH

5.0 Introduction

In the previous chapter, data was presented analysed and interpretations made. In this chapter, research findings are summarised and conclusions made. Then, recommendations and suggestions for further research are stated.

5.1 Summary of Research Findings

In this section, the results of the study are presented in accordance with the study objectives.

Objective number 1: To examine the accessibility interactivity and user-friendliness of computer hardware and software to teachers and students in secondary schools.

From the findings, the issue of access came out as a major indicator of adequacy of computerization efforts in secondary schools. First the study revealed that there is unfavourable student-computer ratio. This negatively impacts on the use of the available computers in meeting teaching and learning needs. Secondly, the physical distribution of computers was found wanting: few computers (2%) were found in the staffrooms. This particularly affects the teachers’ attempt to use IT to meet their instructional needs. Thirdly, data collected indicated that teachers did not consider the computer laboratories conducive for them to use. In addition, more than 50% of teachers lacked basic IT literacy and therefore were not aware of their IT
instructional needs. These teachers could not judge whether computerisation in their schools was adequate or not. Moreover, 35% of teachers have no requisite skills to access the internet. The remaining 65% is not a true figure because more than half of those can only access the Internet on their mobile phones. Among the IT-literate teachers only 29% can access the Web on computers. The study also found that teachers are more likely to access the web for fun rather than to access educational content. Lastly, the researcher noted that where school administrators were supportive, there was better access to computers by teachers and learners.

This study revealed that computers acquired by school through donations and procurement are not user-friendly due to inadequate numbers, slow processor speeds and obsolete software. Computers provided by the Ministry of Education to schools are adequate in numbers and have up-to-date software. The study also revealed that there were inadequate peripheral devices such as printers, scanners and projectors. Finally, the use of old software rendered the computers unuser-friendly.

This study sought to determine the newness of computer hardware and software in secondary schools. Data collected shows that sixty percent of computers are more than seven years old. The software in these computers was also found to be more than six years old. Schools are exclusively using Microsoft Office and Windows Operating Systems, which are not specially tailored to serve instructional needs.

Objective number 2: To assess the cost of acquiring, installing and maintaining computer equipment in secondary schools.
Data gathered in relation to this objective revealed that schools introduced computers in three ways. Five out of six schools got donations from various agencies and personalities. One of the five schools (Kyangwithya) later phased out their old donations when the Ministry of education provided modern computers. The sixth school had all their computers purchased using funds mobilised by parents. In running these ventures, the study revealed that schools were using money from existing vote heads for lack of an IT vote head. This was documented as follows:

a) Tuition Account used to fund consumables
b) Repairs and Maintenance Account used to finance repair and maintenance of computers
c) Development funds to buy new equipment.
d) Personal Emoluments to pay teachers of Computer Studies.

Data from the head teachers, who are accounting officers in their schools, indicated that this kind of financing is not sustainable in the long term. Where funding was provided by the ministry of Education, then the equipment was adequate.

Objective 3: To investigate the ICT teaching and learning needs of teachers and students in secondary schools.

The findings of this study revealed that teachers are aware that computers can make their work easier although a number do not know their specific IT needs. The needs identified were as follows:

(i) They need unlimited Internet connection to supplement their lesson notes.
(ii) Schools to avail digital content for specific subjects
(iii) Schools to avail projectors and associated accessories to make presentations a possibility.
(iv) They would like to be provided with state-of-the-art computers to run better software.

(v) School in conjunction with the Ministry of education to retrain teachers on e-learning.

In addition, the students specified their learning needs. These are as follows:

(i) They would like to see teachers of various subjects using computers in teaching them.

(ii) They would like to gain skills to enable research on the web and be able to type their projects and assignments.

(iii) They would also like to use the Internet to share with students from other schools.

In spite of the needs being articulated so clearly, the same cannot be met adequately because the current status of computer hardware, software and enabling environment is below the expectations of the users; that is, teachers and learners.

Objective 4: To investigate how the school organizational structure influences the accessibility and use of computers for teaching and learning in secondary schools.

Data gathered shows that there is a lack of comprehensive IT policy in secondary schools to guide the acquisition and use of ICT resources in teaching and learning. In the absence of such policies, schools cannot succeed in maintaining acceptable standards of basic IT equipment as an instructional resource. Apart from that, the study discovered that school administrators have not initiated any retraining of teachers to make them IT-compliant. Also, 80 percent of schools do not have computers dedicated to teachers' use.

Moreover, head teachers who are users of computers support the use of computers in their schools – computers in such schools are well maintained. Where head teachers are illiterate in computer use, support is negligible and a large percentage of computers are unserviceable.
The study also found that head teachers were not aware of the existence of the National ICT Strategy for Education and Training that was launched in 2006. They were also not aware that KIE has produced digital content in form of DVD’s.

Objective 5: To establish the types of instructional resources available in secondary schools that can be integrated in ICT instruction.

This study revealed that only 17% of available digital content can be integrated in teaching and learning. The schools lack digital projectors or smart boards to facilitate ICT integration in teaching and learning. Also, schools are yet to acquire e-learning DVD’s for forms one and two produced by KIE. The KIE DVD’s are only available at the institute’s bookshop in Nairobi, making it hard for schools to acquire them.

5.2 Conclusions

From the results of this study, the following conclusions can be made. First, access to computer equipment, software and relevant ICT literacy skills is inadequate in most schools in the country. Secondly, schools do not have reliable financing arrangements to set up and run computerization. This study concludes that using funds from Tuition, PE and RMI accounts is not sustainable since these funds are not adequate. Moreover, with the dynamic nature of ICT, schools cannot keep up with the ever-changing demands of emerging trends without investing more than they can afford presently. Thirdly, the inadequacy of computer equipment and software in schools is a hindrance towards satisfying teaching and learning needs. This because teachers and school managers have not consciously sought e-learning content and hardware that can be integrated in teaching and learning. Fourthly, the use of computers in teaching and
learning cannot be realised unless teachers are empowered to use them in and out of class. Only after they are empowered will they be able to identify their particular ICT needs. Acquiring modern computers without relevant skill development does not foster the use of computers in teaching and learning. Furthermore, this study concludes that access to ICT skills does not automatically translate to improved use of the resource. This study also concludes that school managers have not made any deliberate attempts to streamline use of ICT's in their schools by providing hardware, software and administrative support. When school administrators are literate in ICT use, there are higher chances of ICT ventures in their schools succeeding.

In conclusion, the current status of secondary school computerisation is not tailored towards meeting specific instructional needs; it is inadequate and unsustainable. School computerization should be geared towards achieving teaching and learning objectives. In doing so, all concerned parties must ensure that two aspects are taken care of: that it is adequacy in hardware, software and in skill development; and that it is sustainable in the long run. Without these, schools will continue to lag behind technologically and computers will remain mere artefacts rather than objects of mediated learning as they were meant to be.

5.3 Recommendations

From this study, the researcher would like to recommend the following:

(i) School managers should improve accessibility by improving student-computer ratio, providing access points to teachers and by funding ICT skill development.

(ii) An ICT vote head should be introduced to address financial sustenance of school computerization.
(iii) The Ministry should provide a guideline for acquisition and maintenance of ICT standards in schools in terms of equipment, software and qualification of ICT teachers

(iv) Schools should seek to turn their computer labs into complete e-learning resource centres and maintain a reliable Internet connection

(v) All schools should put in place clear comprehensive ICT policy, spelling out acquisition, hardware/software standards, training, access and related aspects.

(vi) The ministry, through KIE, should make e-learning material available throughout the country and speed up production of form three and four editions.

5.4 Suggestions for further research

Since the scope of this research is limited, the researcher would like to make suggestions on areas in which further research can be carried out.

1. A study to document the ICT needs of secondary schools in Kitui.

2. Investigate the impact of computerisation on academic performance and on the efficient management of schools.

3. Assess the impact of using computer-assisted learning in achieving learning objectives in specific subjects

4. Investigate the role of the school managers’ attitude in influencing sustainability of secondary school computerization.

6. Assess the factors responsible for sustainable use of ICT's in teaching and learning.
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APPENDIX I

QUESTIONNAIRE FOR TEACHERS OF VARIOUS SUBJECTS

This questionnaire is part of my M.Ed. study that I am undertaking at the Department of Educational Communication and Technology, School of Education, Kenyatta University. One of my goals is to assess the accessibility of computers to teachers as a measure of adequacy of available computers in teaching and learning. So as to understand this, it is important that teachers give their views on this matter. Knowledge gained from the study will constitute useful data for my research and can be of help in policy making in the area of computerization of schools. Respond to all items as accurately as possible. The information you provide will help us understand the factors influencing the success or failure of school computerization and how best to approach implementation of computers for all schools by the year 2012. All information you provide is treated in strict confidence and shall be used for the stated purposes only. I will appreciate your taking the time to complete this questionnaire.

Indicate with a tick your preferred response where choices are provided.

BASIC INFORMATION

1. What are your teaching subjects? I. ______________________ II ______________________

2. Please indicate your teaching experience ______________________ years.

3. What is your highest academic qualification?

   Masters Degree [ ] Bachelors Degree [ ] Diploma [ ]

4. Do you believe that computers can enhance teaching and learning?

   [ ] Yes.
   [ ] No
   [ ] I don’t know

5. How many years have you used computers in the course of your teaching? __________

6. (a) Do you have an email address?
Accessibility of Computers for Use in Teaching and Learning

7. Do you use computer in the course of your work?
   - in school: [ ] Yes [ ] No
   - out of school: [ ] Yes [ ] No

If yes, specify how you use it. (You can tick more than once)
A. [ ] Classroom presentations using PowerPoint
B. [ ] Preparation of lesson notes and schemes of work using word processor
C. [ ] Setting tests and examination papers
D. [ ] Preparing students' database
E. [ ] Using spreadsheets to record and analyze students' marks
F. [ ] Carrying out research on the internet to supplement lesson notes and the text book.
G. [ ] Presenting multimedia stimuli (playing CDs, DVDs teaching resources)
H. [ ] Using subject-specific Interactive exercises – computer assisted learning
I. [ ] Using Microsoft Encarta encyclopaedia in and out of class
J. [ ] Using virtual dictionaries and thesaurus in English lessons e.g. Longman Dictionary of Contemporary English or Macmillan Dictionary of advanced Learners (available on CD), WordWeb etc.
K. Any other (please specify) ..........................................................................................................................

8. Do you have access to any educational software in the school?
   - [ ] Yes
   - [ ] No

If yes, explain which one ..........................................................................................................................

9. Which of the following accurately describes how you acquired your computing skills?
   A. [ ] College/university training as part of the course
   B. [ ] Computer literacy course at college/university
   C. [ ] Self initiative at a commercial/private college
   D. [ ] School-sponsored in-service workshops/seminars
   E. [ ] From interest – learning on the job
   F. [ ] Learning from colleagues at school
   G. Other ..............................................................................................................................................
10. Where do you access computer in school when you want to use one?
   A. [ ] In the computer lab
   B. [ ] In the staffroom
   C. [ ] In the department office
   D. [ ] At the typing pool
   E. [ ] At the reception
   F. [ ] Any other

11. When do you access computers in school?
   A. [ ] During specific times as provided in the teaching timetable
   B. [ ] During my free time
   C. [ ] Any other
       (specify)

12. On average, how many hours in a week would you say you are able to use computers in school?
   A. [ ] Below 1 hour
   B. [ ] 1 to 2 hours
   C. [ ] 3 to 4 hours
   D. [ ] 5 to 6 hours
   E. [ ] Over 6 hours

13. How would you rate your general access to available computers?
   A. [ ] Computers are accessible but only few teachers can use them
   B. [ ] Teachers compete to use available computers
   C. [ ] Computers available only to those interested
   D. [ ] Use of computers is restricted by the school administration
14. a) Do you use the Internet?  Yes [ ]  No [ ]

b) If yes, what do you normally use the internet for?
   A. [ ] Surf for fun
   B. [ ] Searching and downloading information for personal use
   C. [ ] Searching for educational resources to supplement your teaching notes
   D. [ ] Send and receive email
   E. [ ] Others .................................................................

15. a) Does your school have an Internet connection?
   A. [ ] Yes
   B. [ ] No
   C. [ ] I don’t know

(b) If yes, do you have access to the school Internet connection?
   A. Yes [ ]
   B. No [ ]

16. If yes how would you rate the administration requirements to this access?
   A. [ ] Internet use is restricted by the administration
   B. [ ] Access is limited to sending and receiving official correspondence
   C. [ ] The connected computer is not readily available
   D. [ ] Teachers are charged to use the internet
   E. [ ] Teachers’ use of the internet is closely monitored
   F. [ ] Teachers freely access the Internet to meet their needs
   G. [ ] Internet use is available to only those who know how to use it.

17. If you don’t access the Internet using school computers, how do you access the Internet?
   A. [ ] On Mobile Phone
   B. [ ] At a cyber cafe
   C. [ ] A personal computer or a laptop with Internet connection
   D. Any other (specify) ..................................................
18. Please comment on the adequacy of available hardware and software in meeting educational needs.

(Adequacy is the sufficiency of computers in quality or quantity in meeting your teaching and learning needs.)

<table>
<thead>
<tr>
<th></th>
<th>Very adequate</th>
<th>Adequate</th>
<th>Inadequate</th>
<th>Very inadequate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of computers available</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Software/programs installed</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Models of available computers</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

19. Would you say your school is able to sustain the use of computers for teaching and learning?

[ ] Yes  [ ] No

Please explain your answer.

20. Please comment on the user-friendliness of available software in meeting educational needs. (user-friendly machines and programs are easy to operate, understand, or deal with)

A. [ ] Very user-friendly
B. [ ] User-friendly
C. [ ] Not user-friendly

21. Please specify what hardware and or software you would like to see your school acquire to serve educational needs.

22. Use this space to specify the other needs you have that you would like to be satisfied by computer technology in your teaching

Teachers' Awareness and opinions towards computers and computer-literacy

23. If you don’t use computer, what reason would you give for not doing so?
24. In your opinion, how should teachers acquire necessary ICT skills?

- [ ] It's my initiative to become computer-literate
- [ ] The Ministry of Education should conduct in-service courses for teachers
- [ ] The BOG/school administration should sponsor teachers' computer courses
- [ ] Teachers need not use computers in their work
- [ ] Any other...

25. Which areas do you think the computer can be used in school to improve teaching and learning?

- [ ] using interactive smart boards in class
- [ ] using data projectors in doing presentations in Geography and sciences
- [ ] e-content applications – computer-aided instruction.
- [ ] on-line resources: using the Internet and CDs/DVDs resources
- [ ] preparation and management of teaching records
- [ ] using Online dictionaries and standardised self-tests in English class
- [ ]

26. What would you like the school administration to do to facilitate better utilization of computers in your school?

Thank you for taking time to answer the questions.
APPENDIX II

COMPUTER TEACHERS' QUESTIONNAIRE

SCHOOL .................................................................

This questionnaire is part of my M.Ed. course that I am undertaking at the Department of Educational Communication and Technology, School of Education, Kenyatta University. One of my goals is to assess the status of computerization in schools. So as to understand this, it is important that you, teachers of Computer Studies give your views on this matter. Knowledge gained from the study will constitute useful data for my research and can be of help in policy making in the area of computerization of secondary schools. Respond to all items as accurately as possible. The information you provide will help us understand how computer resources are managed in secondary schools and how best to sustain computerization in schools. All information you provide will be treated in strict confidence and shall be used for the stated purposes only. I will appreciate your taking the time to complete this questionnaire.

Indicate with a tick your preferred response where choices are provided.

BASIC INFORMATION

1. Indicate your gender by ticking.
   A. [ ] Male
   B. [ ] female

2. What is your highest academic level?
   A. [ ] Bachelor's Degree
   B. [ ] Diploma
   C. [ ] Certificate
   D. [ ] Other (specify) .................................

3. What are your professional qualifications?
   A. [ ] M.Ed.
   B. [ ] B.Ed.
   C. [ ] Dip. Ed
   D. [ ] TEP Diploma
   E. [ ] Any other (specify) ............................

4. Who is your employer?
   A. [ ] Teachers' Service Commission
   B. [ ] Board of Governors
   C. [ ] Other (specify) .................................

HARDWARE

5. How many computers do you have in the lab?
6. How many of the following types of processors do you have in the lab? Specify the serviceable ones and those out of order.

<table>
<thead>
<tr>
<th>TYPE</th>
<th>How many?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Functional ones</td>
</tr>
<tr>
<td>486/386</td>
<td></td>
</tr>
<tr>
<td>Pentium 1 &amp; 2</td>
<td></td>
</tr>
<tr>
<td>Pentium 3</td>
<td></td>
</tr>
<tr>
<td>Pentium 4</td>
<td></td>
</tr>
<tr>
<td>Celeron</td>
<td></td>
</tr>
<tr>
<td>Centrino</td>
<td></td>
</tr>
<tr>
<td>Dual core</td>
<td></td>
</tr>
</tbody>
</table>

How many computers have the following devices?

<table>
<thead>
<tr>
<th>Device type</th>
<th>Number of computers with device</th>
</tr>
</thead>
<tbody>
<tr>
<td>CD/DVD Rom</td>
<td></td>
</tr>
<tr>
<td>CD/DVD R/RW</td>
<td></td>
</tr>
<tr>
<td>Modem</td>
<td></td>
</tr>
<tr>
<td>USB port</td>
<td></td>
</tr>
<tr>
<td>Speakers</td>
<td></td>
</tr>
</tbody>
</table>

7. Indicate how many of these devices you have.

<table>
<thead>
<tr>
<th>Device Type</th>
<th>How many Available?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Functional ones</td>
</tr>
<tr>
<td>Inkjet Printers</td>
<td></td>
</tr>
<tr>
<td>Laser printer</td>
<td></td>
</tr>
<tr>
<td>Scanner</td>
<td></td>
</tr>
<tr>
<td>Digital projector</td>
<td></td>
</tr>
<tr>
<td>Digital camera</td>
<td></td>
</tr>
<tr>
<td>Interactive white boards</td>
<td></td>
</tr>
<tr>
<td>UPS</td>
<td></td>
</tr>
</tbody>
</table>
8. a) Do you have an internet connection?
   A. [ ] Yes
   B. [ ] No

   b) If yes, what type?
   A. [ ] A leased line
   B. [ ] GPRS
   C. [ ] 3G Mobile
   D. [ ] Dial-up connection
   E. [ ] Wireless LAN connection

c) How many computers are connected to the internet?

d) Do you have a Local Area Network facility in your school?
   o [ ] Yes
   o [ ] No

9) a) Do you consider the available hardware adequate in meeting your school’s teaching and learning needs?
   o [ ] Yes
   o [ ] No

   b) If your answer is NO, please specify type of hardware that you require to meet the school’s needs.

SOFTWARE

10) a) What Operating System do you use? You can tick more than one choice.

   A. [ ] Ms Dos
   B. [ ] MS Windows 95/98
   C. [ ] Windows 2000/ME
   D. [ ] Windows XP Which Service Pack? .....................
   E. [ ] Windows Vista
   F. [ ] Windows 7
   G. [ ] Linux
   H. [ ] Mac Os
   I. [ ] Any other (specify) ........................................................................................................

   b) Do you have original software Disks for these software?
      o [ ] Yes
c) If using Microsoft Office, indicate which versions

<table>
<thead>
<tr>
<th>Software version</th>
<th>Number of computers program is installed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microsoft Office 97</td>
<td></td>
</tr>
<tr>
<td>Microsoft Office 2000</td>
<td></td>
</tr>
<tr>
<td>Microsoft Office 2003</td>
<td></td>
</tr>
<tr>
<td>Microsoft Office 2007</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
</tr>
</tbody>
</table>

d) Indicate whether you have the following software

<table>
<thead>
<tr>
<th>Programs</th>
<th>Number of computers program is installed</th>
<th>Which version?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Graphics programs (e.g Photoshop)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Desktop publishing (e.g Pagemaker)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PDF reader</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Microsoft Encarta</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other (specify)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

e) Please indicate any other application software in use in the school.

o ..............................................................

f) Do you have any subject-specific software you use?

[ ] Yes
[ ] No

g) If yes, please describe it and say whether it is usable or not.

h) Do you consider the software available adequate?

[ ] Yes
[ ] No

i) If NO, what software do you need to adequately serve your needs? Please explain.

Service and Maintenance

11. a) How often are computers serviced?
b) Who services the computers?
A. [ ] A contracted firm
B. [ ] The computer supplier
C. [ ] A computer technician employed by the school
D. [ ] The computer teacher
E. [ ] Any teacher who is computer-literate
F. [ ] No specific person

C) Do you consider the servicing schedule adequate?
A. [ ] Yes
B. [ ] No

D) If no, what do you need in terms of servicing and maintenance to keep the lab up and running?

12. Do you think the school is able to sustain the management and use of computers in the long run?
A. [ ] Yes
B. [ ] No

Teaching and learning

13. a) What content do you teach?
A. [ ] Recommended KIE syllabus for Computer Studies
B. [ ] Basic IT Literacy skills
C. [ ] Application packages
D. [ ] all the above
E. [ ] we don’t follow a specific syllabus
F. [ ] Other Courses (specify)

b) Do you use the internet to supplement your teaching materials?
A. [ ] Yes
B. [ ] No
c) Do teachers of other subjects have access to the lab for use in teaching and learning?
   A. [ ] Yes
   B. [ ] No
   Please explain your answer.

d) Approximately, how many hours do you have the lab free for use by other teachers?

e) Do teachers make use of the available time to use the lab?

f) Do you assist other teachers in learning how to use computers?
   A. [ ] Yes
   B. [ ] No

  g) If yes, please specify the type of assistance you provide?

h) Briefly describe the challenges you face in teaching computer skills/computer studies.

i) What would you like the school administration to do to facilitate better utilization of computers in your school?
APPENDIX III
HEAD TEACHERS' INTERVIEW SCHEDULE

Name of school: .................................................................
Email address: ............................................................. Website address: ..........................................................
Fax: .............................................. Phone No: ........................................ Mobile: ........................................
Student population: ......................................................
No. of teachers: ..............................................................

Policy

1. For what use are computers to your school?

2. a) Do you have an IT policy in place in this school?

b) What aspects does it cover?

c) Are you aware of the National ICT Strategy for Education and Training?

3. a) Do you have a policy of computer literacy for all students in your school?

b) Do you have a policy requiring teachers to be computer-literate?

4. a) What were the objectives for introducing computers in this school?

b) Was needs assessment done before introduction of computers?

Funding

5. a) Is there a vote-head specifically set aside to fund your IT needs in school?

b) If yes, how much have you set aside this year?

c) If no, how does the school sustain the computers use?

6. How were the available computers acquired?

7. How is the school computer project funded?

8. Do you charge students computer studies fee? If yes, what is it used for?

9. Would you say the school is able to sustain the use of computers? How can we make computerization in this school sustainable?
Maintenance

10. a) Do you have a computer technician?
   b) If no, how is servicing and maintenance done?
   c) Do you find the kind of servicing done here adequate?

Costs

11. a) Please specify the items in your annual expenditure that relate to computer use.
   b) If you don’t have a computer vote head, how do you account for this expenditure?
   c) What do you do with computers that are no longer serviceable?
   d) Do you know of any agency that helps institutions in disposing of e-waste?
   e) Do you find computerization in this school sustainable?

Staff training

12. a) How many teachers do you have in your staff?
   b) How many members of staff are computer-literate?
   c) How many teachers are regular users of the computer for their instructional needs?
   d) Have you made any arrangements for teachers to be in-serviced in the use of computers for educational purposes? Please explain.

Accessibility

13. a) Are there computers specifically set aside for use by teachers?
   b) Do teachers have access to the computer lab?

14. Apart from the computer lab, where else are computers located within the school

Computer use in school
15. a) Do you use computers in your school administration? How? Please explain.

b) For what other purposes are computers used in the school?

c) Are computers in your school used as a teaching and learning resource?

d) Are teachers integrating computer courses with class curriculum?

e) KIE has produced e-learning material for forms one and two. Have you acquired them?

f) In which areas do you think computers can be used to enhance teaching and learning in your school?
Appendix IV: Questionnaire for Students

SCHOOL .................................................................

This questionnaire is part of my M.Ed. course that I am undertaking at the Department of Educational Communication and Technology, School of Education, Kenyatta University. One of my goals is to study the ICT needs of learners in secondary school. So as to understand this, it is necessary you give your views on the adequacy of computers in serving your needs. All information you provide will be treated in strict confidence and shall be used for the stated purposes only. I will appreciate your taking the time to complete this questionnaire.

Indicate with a tick your preferred response where choices are provided.

1. a) Are you satisfied with the number of computers available for your use in school?
   A. [ ] Yes  
   B. [ ] No  
   C. [ ] I don’t know

2. a) Are the available computers easy to use?
   A. [ ] Yes  
   B. [ ] No  
   C. [ ] I don’t know  
   b) If no, what could explain the reason why computers are not easy to use?
      A. [ ] Computers are often broken down  
      B. [ ] Installed Programs are too old  
      C. [ ] Power sockets are not enough.  
      D. [ ] computer teacher is not always available

3. a) Are you allowed to use computers during your free time?
   A. [ ] Yes  
   B. [ ] No  
   b) If no, what would you like the school administration to do to improve this.
   c) If yes, explain how you use the computers during your free time?

4. a) Apart from the Computer Studies teacher, do other teachers use computers in teaching various subjects?
   A. [ ] Yes  
   B. [ ] No  
   b) If yes, explain briefly how they use them to help in teaching and learning.

5. Are you charged any Computer Studies fee?

6. Mention some of the things you are able to do with computers on your own here in school.
7. Do you consider your computing skills adequate? If no, why aren’t they?

8. a) Do available computers benefit you?
   A. [    ] Yes
   B. [    ] No
   b) If no, briefly explain what you would like the school administration to do to make computers in your school more useful to you.

9. Mention how computers in your school can be used to help you in learning other subjects.

10. What problems do you face when using computers in school?
Appendix V: CHECKLIST FOR ICT FACILITIES

Name of school: .................................................................

A. Aspects covered by school IT policy

<table>
<thead>
<tr>
<th>Component</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objectives – the purpose of adopting IT use</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Procurement procedures</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Servicing and maintenance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Replacement of hardware/software</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disposal of computers and peripherals no longer needed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rules governing students’ use</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rules governing teachers, use</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others (specify)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

B. Recurrent expenditure

<table>
<thead>
<tr>
<th>Item</th>
<th>Approx cost (K.Sh.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purchase of new hardware</td>
<td></td>
</tr>
<tr>
<td>Service and maintenance</td>
<td></td>
</tr>
<tr>
<td>Consumables (Ink cartridges)</td>
<td></td>
</tr>
<tr>
<td>Internet charges</td>
<td></td>
</tr>
<tr>
<td>Insurance on equipment</td>
<td></td>
</tr>
<tr>
<td>Retraining of Staff</td>
<td></td>
</tr>
<tr>
<td>Salaries for Computer technician/teacher and user support,</td>
<td></td>
</tr>
<tr>
<td>Systems software and applications</td>
<td></td>
</tr>
<tr>
<td>Subject specific software</td>
<td></td>
</tr>
<tr>
<td>Software licensing and upgrading</td>
<td></td>
</tr>
<tr>
<td>Planning and administration costs</td>
<td></td>
</tr>
</tbody>
</table>
C. Areas of Computer use in school

<table>
<thead>
<tr>
<th>Areas of use</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managing Employee records</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Managing a Students’ database and fees payment records</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Typing and printing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Processing and management of examination results – preparation of report forms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Management of Stores and library</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communication – sending email messages and faxing - networking</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Typesetting of school magazine</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

D. Computers processors

<table>
<thead>
<tr>
<th>TYPE</th>
<th>How many?</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Functional ones</td>
<td>Broken down</td>
<td>Total</td>
<td></td>
</tr>
<tr>
<td>486/386</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pentium 1 &amp;2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pentium 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pentium 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Celeron</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Centrino</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dual core</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

E. Computers have the following devices?

<table>
<thead>
<tr>
<th>Device type</th>
<th>Number of computers with device</th>
</tr>
</thead>
<tbody>
<tr>
<td>CD/DVD Rom</td>
<td></td>
</tr>
<tr>
<td>CD/DVD R/RW</td>
<td></td>
</tr>
<tr>
<td>Modem</td>
<td></td>
</tr>
<tr>
<td>USB port</td>
<td></td>
</tr>
<tr>
<td>Speakers/sound card</td>
<td></td>
</tr>
<tr>
<td>Network award</td>
<td></td>
</tr>
</tbody>
</table>

F. Peripherals
<table>
<thead>
<tr>
<th>Device Type</th>
<th>Functional ones</th>
<th>Grounded ones</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inkjet Printers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laser printer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scanners</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Copiers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Digital projector</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Digital camera</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interactive white boards/smart boards</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UPS</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**G. Software**

<table>
<thead>
<tr>
<th>Operating System</th>
<th>available</th>
<th>Availability of original software discs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ms Dos</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MS Windows 95/98</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Windows 2000/ME</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Windows XP</td>
<td></td>
<td>Which Service Pack?</td>
</tr>
<tr>
<td>Windows Vista</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Windows 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Linux</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mac Os</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any other (specify.)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**H. Microsoft Office Versions**

<table>
<thead>
<tr>
<th>Software version</th>
<th>Number of computers program is installed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microsoft Office 97</td>
<td></td>
</tr>
<tr>
<td>Microsoft Office 2000</td>
<td></td>
</tr>
<tr>
<td>Microsoft Office 2003</td>
<td></td>
</tr>
<tr>
<td>Microsoft Office 2007</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
</tr>
</tbody>
</table>
## I. Applications

<table>
<thead>
<tr>
<th>Programs</th>
<th>Number of computers program is installed</th>
<th>Which version?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Graphics programs (e.g Photoshop)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Desktop publishing (e.g Pagemaker)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PDF reader</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Microsoft Encarta</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subject-specific E-content applications</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OtherS (specify)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Other Items to Check

- The number of computer labs/multimedia centres in school
- The size/seating capacity of computer labs
- Physical accessibility/location of the labs
- The number of hours computer lab is free of Computer Studies lessons
- Availability of an Internet connection
- Availability of Email facility
- Availability of fully established LAN (routes and access points)
- Availability of servers
- Is there sufficient power cabling/wiring?
- Nature of furniture and fittings in the lab
- Availability of an inventory in the stores ledger – consumables (ink cartridges, toners, print paper)
- Is there a repair and maintenance record showing dates and nature of repairs?
- Evidence of procurement – Local purchase Orders, delivery notices, and invoices.
- Teaching timetable – the number of hours the computer lab is free in a week
APPENDIX VI

LIST OF SCHOOLS IN THE RESEARCH POPULATION

<table>
<thead>
<tr>
<th></th>
<th>School Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Muthale Girls Secondary School</td>
</tr>
<tr>
<td>2</td>
<td>Mutonguni Secondary School</td>
</tr>
<tr>
<td>3</td>
<td>Kyondoni Girls Secondary School</td>
</tr>
<tr>
<td>4</td>
<td>Matinyani Boys Secondary School</td>
</tr>
<tr>
<td>5</td>
<td>St. Angela's Girls Secondary School</td>
</tr>
<tr>
<td>6</td>
<td>St. Charles Lwanga Secondary School</td>
</tr>
<tr>
<td>7</td>
<td>Kitui School</td>
</tr>
<tr>
<td>8</td>
<td>Mulango Girls Secondary School</td>
</tr>
<tr>
<td>9</td>
<td>Kyangwithya Secondary School</td>
</tr>
<tr>
<td>10</td>
<td>Maliku Girls Secondary School</td>
</tr>
<tr>
<td>11</td>
<td>Chuluni Girls Secondary School</td>
</tr>
<tr>
<td>12</td>
<td>Tungutu Girls Secondary School</td>
</tr>
<tr>
<td>13</td>
<td>Mbitini Girls Secondary School</td>
</tr>
<tr>
<td>14</td>
<td>Mutito Girls Secondary School</td>
</tr>
<tr>
<td>15</td>
<td>Mutito Boys Secondary School</td>
</tr>
<tr>
<td>16</td>
<td>Kisasi Boys Secondary School</td>
</tr>
<tr>
<td>17</td>
<td>Sombe Girls Secondary School</td>
</tr>
<tr>
<td>18</td>
<td>Yumbisye Secondary school</td>
</tr>
<tr>
<td>19</td>
<td>Kauma Secondary School</td>
</tr>
<tr>
<td>20</td>
<td>Mulutu Secondary school</td>
</tr>
</tbody>
</table>