FACTORS INFLUENCING INTEGRATION OF INFORMATION AND COMMUNICATION TECHNOLOGY IN TEACHING AND LEARNING IN SECONDARY SCHOOLS IN MATHIOYA DISTRICT OF CENTRAL PROVINCE, KENYA

BY

KARIMI ELIJAH KAHANDO

A RESEARCH PROJECT REPORT SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTER OF ARTS IN PROJECT PLANNING AND MANAGEMENT OF THE UNIVERSITY OF NAIROBI
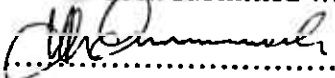
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DECLARATION

This research project is my original work and has not been presented in any other university.

Signature..Date.08/08/2010

NAME: Karimi Elijah Kahando

Reg. No.   L50/72595/2008

This project report has been submitted with my approval as University Supervisor.

Signature...Date....9/8/2010

Dr. Harriet Kidombo

Senior Lecturer, Department of Educational studies

University of Nairobi

DEDICATION

This research project is dedicated to my parents, brothers, sisters and my girlfriend Carol

Nyaga and Davy. You have been a source of strength, support and encouragement.

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ABBREVIATIONS AND ACRONYMS

BECTA- British Educational Communications and Technology Agencies

CAI- Computer Aided Instructions

GOK- Government of Kenya

ICT – Information and communication technology

InfoDev- Information for Development Program

IT – Information technology

LANs- Local Area Networks

LDC- Less Developed Country

MIS- management of information system

MOEST-Ministry of Education Science and Technology

SPSS – Statistical package for social sciences

TPD- Teacher professional development

UK- United Kingdom

UN- United Nation

UNESCO- United Nations Education, Scientific and Cultural Organization

SA- Strongly agree

A- Agree

U- Uncertain

D- Disagree

SD- Strongly disagree

ABSTRACT

The study explored factors influencing integration of ICT in teaching and learning in secondary schools in Mathioya District. The data was collected by means of questionnaires from 52 teachers, and interviews from four principals. Observation was also used to confirm presence of ICT infrastructure.

The objectives of the study were; to establish the influence of ICT infrastructure and access to integration of ICT in teaching and learning, to examine influence of teachers' ICT knowledge and skills on integration of ICT in teaching and learning, to investigate the extent to which technical support influence integration of ICT in teaching and learning and to establish the influence of teachers' time on integration of ICT in teaching and learning.

The findings indicated scarcity of ICT infrastructure. The cost of both software and hardware are quite prohibitive and therefore majority of schools cannot afford them nor cope up with cost of technology sustainability in terms of purchase, upgrading and maintenance.

Majority of teachers view capacity as far ICT skills are concerned as a factor that influences adoption of ICT in their daily practices. Teacher education program were not modeled to provide prospective teachers with ICT knowledge and skills that support use of technology in educational setting.

ICT support was found to be crucial if teachers have to work without disruption through having to fix software and hardware problems. Technical support was lacking in almost all schools.

From the findings, it was noted that teachers make little use of ICT due to lack of time. They felt huge teaching load left them with little or no time to prepare and experiment with digital materials for use in classroom.

From the findings, majority of teachers believed that ICT is a vital tool that improves efficiency and effectiveness in teaching and learning. However, they felt that to realize the full benefits that ICT can bring, a batch of factors has to be addressed.

The study recommends government intervention to ensure equity in terms of provision of quality education by allocating funds to cater for ICT programs, facilitate continuous and sustainable professional development and review of curriculum to take into account current technological changes and their impact in the society.

CHAPTER ONE

INTRODUCTION

1.1 Background to the study

Information communication technologies (ICTs) have produced remarkable changes over the last decade. It has affected the demands of societies in the information age. Governments around the world have been promoting the use of new technologies after realizing the potential benefits they have on the work place and everyday life. Today's education institutions try to reorganize their educational programs and classroom facilities, in order to minimize the teaching and learning technology gap between developed and developing countries. The reformation process involves integration of ICTs into existing education settings in order to provide learners with knowledge and skills that will promote professional productivity.

The Government of Kenya (GOK) is committed to provide quality education to all citizens as a precondition for social and economic development. A shift to a knowledge-based economy requires that educational institutions equip individuals with ability to transform information into knowledge and apply it. ICTs have the potential to play a powerful role in enhancing the tools and environment of learning and preparing students to acquire skills, competencies, and social skills fundamental for competing in the emerging global knowledge economy (MOEST, 2005). ICTs are a vital means in today's educational institutions to facilitate collection, organization, and storage of information to ease timely communication necessary for decision making.

ICT is an effective tool that if integrated successfully, forms a key support of education and training (Tomar and Kumari, 2005). Use of ICT in education has been a priority in most countries since 1980s but the progress has been uneven (Balanskat, Blamire and

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Kefala, 2006). Differences emerge on level of e-maturity within and between countries and between schools within countries.

Although most secondary schools in Kenya have some equipment, ICT has not been integrated in teaching and learning as result of diverse factors. Most schools in rural areas in Kenya do not have access to basic amenities like electricity and telephone infrastructure and experience high level of poverty (MOEST, 2005). This makes it difficult for such schools to own information because they cannot purchase ICTs infrastructure like computers which are major tools for accessing information. Research has shown that the core problem that faces the country is lack of adequate connectivity and network infrastructure (Ngugi, 2007). The situation in different urban areas may have been influenced positively by the wide use of English, in which most IT services are conducted. This creates a "digital divide" and raises the question of whether the application of these technologies to improve information and communication access can increase capabilities of disadvantaged rural schools (Birungi and Musoke, 2004).

ICT integration in school requires investment in equipment, professional development, technical support, connectivity and digital learning process. It is an effective and sometimes complex process. However, its advantages are evident and their benefits that can bring to schools and their pupils are important enough to make the introduction of technology into the classroom a priority of educational planners in both developed and developing countries (UNESCO, 2003). Therefore, teachers and schools administrators must exploit ICTs to open and expose learners to the contemporary world of knowledge.

1.2 Problem statement

Kenya is rich in natural resources than current economically developed countries such as Singapore. In 1965, Singapore was much like Kenya but the level of development she has

achieved is amazing. But Kenya continues to lag behind economically. There exists a wider knowledge gap between Kenya and Singapore in terms of knowledge and skills, institutional capabilities and organizational structures required to benefit from the vast quantities of information available in the world today (Kriz and Qureshi, 2009). They reports that Singapore has long history of technology enabled transformation as it relies on its skilled personnel to produce goods and services.

In Kenya there has been substantial growth in the IT sector which has strengthened issues of communication for development. But there have been drawbacks in terms of technology literacy and accessibility (MOEST, 2005). Only a small proportion of the population has the knowledge and ability to use computer and other newer technologies. Research has revealed that the role of ICT in improving the lives of people cannot be under estimated (Langmia, 2005). For example, the growth of mobile banking in Kenya such as M-pesa, Yu-cash and Zap by mobile service providers, have made people who do not have access to traditional banks to undertake money transfer easily, quickly and safely. Innovations such as internet and cell phone have made previously disenfranchised population have a voice.

Education and training has been theorized as a tool for economic growth. But Bollou and Ngwenyama (2008) are of the view that, quality education can be achieved through putting in place policies and strategies that will lead to the adoption of ICT in learning institutions. Students graduating from institutions that have assimilated ICTs have potential to operate in the information society. If adequately and practically adopted, ICT becomes a strong support to enhance teaching and learning, and everyday life.

However, it has been scarcely integrated in most of the secondary schools even with the government tax relief on imports of computers and communications related equipment intended to boost the spread of information in the country. Therefore, the study sought to

investigate factors influencing the integration of ICT in teaching and learning of secondary schools in Kenya.

1.3 Purpose of the study

The purpose of the study was to investigate the factors that influence integration of ICT in teaching and learning in secondary schools in Mathioya District. The study focused on teachers' use of ICT.

1.4 Objectives of the study.

The objectives of the study were;

1. To examine the influence of ICT infrastructure and access to integration of ICT in teaching and learning.

2. To determine the influence of teachers' ICT knowledge and skills in integration of ICT in teaching and learning.

3. To establish the extent to which technical support influence ICT integration in teaching and learning.

4. To establish the influence of teachers' time on integration of ICT in teaching and learning.

1.5 Research questions

The study was guided by the following research questions:

1. How do ICT infrastructure and access influence integration of ICT integration in teaching and learning?

2. In what ways do teachers' ICT knowledge and skills influence integration of ICT in teaching and learning?

3. How does technical support influence integration of ICT in teaching and learning?

4. How does teachers' time influence integration of ICT in teaching and learning?

1.6 Significance of the study.

The information gathered through this research will provide useful data to the Ministry of Education, administration of secondary schools, ICT curriculum developers, schools intending to initiate ICT and other education stakeholders. The data may be useful in appropriate decision making in a bid to improve and appropriately implement ICT in our secondary schools. Studying the factors influencing use of ICT in teaching and learning environment is crucial because this knowledge could provide guidance for ways to enhance technology integration and encourage greater use of ICT in schools. Identifying the fundamental factors may assist teachers and educators to overcome these barriers and become successful technology adopters.

1.7 Limitations of the study.

The sample size was small resulting in reduced generalizability. The schools in Mathioya District have numerous similarities making the homogeneous sample for this study. Also the timeframe for the study limited the sample size.

Some participants were difficult to contact or too busy to participate in the study. Some interviewees were not willing to share information on ICT use in their school. Others were not familiar with ICT.

1.8 Delimitation of the study.

The literature review contextualizes the study and assisted in grounding the findings and conclusion in the literature. Furthermore, ICT use in education is at a dynamic stage in Kenya. Therefore, the study needs to be seen as a picture of current developments during the time of study. Also, the study was aimed at providing in-depth understanding of the state of ICT integration in the selected area. The study also generated information which will be useful to other schools.

Substitute interviewees were selected. The interview structured questions were modified after initial interviews to make them clear for those who were unfamiliar with ICT.

1.9 The scope of the study

The study was carried out in Mathioya District of Central Province, Kenya. It involved thirteen schools out of the current twenty nine. The study focused on teachers' use of ICT in teaching and learning.

1.10 Assumptions of the study.

The researcher assumed that the data obtained from the staff was accurate, and the respondents were honest in giving responses through the questionnaires and interview schedules.

1.11 Definitions of significant terms.

Digital divide: Refers to the gap between people with effective access to digital and information technology and those with very limited or no access at all. It includes the imbalances in physical access to technology as well as the imbalances in resources and skills needed to effectively participate as a digital citizen.

ICT infrastructure

and access: Physical equipment/hardware and software that enables a network to function. Access is availability of ICT infrastructure.

ICT integration: Educators' use of technology to enhance instruction and create rich environments to help each individual learner develop a depth of understanding and critical thinking skills.

ICT knowledge

and skills: This is competence to handle hardware, software, curriculum (re)design, coaching, monitoring, developing digital material, developing vision of ICT in education, cooperation with colleagues etc, (UNESCO, 2003)

Information age: A period in the last quarter of the 20th century when information becomes easily accessible through publications and through the manipulation of information by computers and computer networks.

Information and Communication

Technologies: Includes technologies both traditional (e.g. radio, television, print, video/film) and newer technologies (internet, virtual reality, distance education, mind-computer interface technologies, mobile phones etc)

that are intended to fulfill information processing and communication functions.

Information system: set of interrelated components that collect (retrieve), process and store and distribute information to support decision making and control in an organization.

Information technology: Information technology refers to both the hardware and software that are used to store, retrieve, and manipulate information in order to achieve organization objectives.

Knowledge economy: An economy in which the generation and exploitation of knowledge play the predominant part in the creation of wealth.

Management information System: It is a system using formalized procedures to provide management at all levels in all functions with appropriate information, based on data from both internal and external sources, to enable them to make timely and effective decisions for planning, directing and controlling the activities for which they are responsible (Lucy, 1997)

Technical support: Basic troubleshooting skills to overcome technical problems when ICT is applied. It can be provided by in-school staff or external service provider, or both.

1.12 Summary

There has been a rapid growth in awareness of the importance of both quality and quantity of human resources. This has resulted in an increased need for relevant and high quality of education and training in society. Therefore, governments all over the world have embarked on ambitious initiatives to infuse technologies in learning institutions. This will equip young and old with knowledge and skills that are pre-requisite for sustainable development. The present era of information age require individuals with ICTs skills, who can contribute in the emerging global knowledge economy. The education sector in Kenya has not fully embraced the use of ICTs. ICT integration demands that factors influencing ICT adoption be addressed before any attempt to its introduction. These include: infrastructure and access, professional development, technical support, teachers' time among others.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The chapter explores existing literature on integration of ICT in teaching and learning. It begins by looking at ICT in education in general, ICT and education in Kenya, ICT policies, benefits of ICT, factors influencing integration of ICT in teaching and learning, and integration of ICT in teaching and learning.

2.2 ICT in education

Since the 1980s, countries around the world have been promoting the use of information and communication technologies (ICTs) in education. Education is fundamental to development of dynamic labour force capable of accessing and integrating knowledge into social and economic activities and facilitating in today's global economy (World Bank, 2003). Quality education is a precursor to development. Quality in education can be achieved through utilization of technologies that enhances teaching and learning. In education, ICT needs to be seen in the core purpose of school activities. Computers must offer more to all the students in school, other than just computer studies. Mahapatra (2005) notes that, ICTs contribute immensely towards the process of teaching and learning.

The impact of ICT in our daily life has led many education institutions to redefine their education program and classroom facilities in an effort to harness the immense benefits derived from utilizing new technology. The nature of the ICT adoption goes beyond using information and communication systems to improve education administration; to large scale adoption of technologies that impact on curricular and pedagogical structures (Wai-Kong, 2009).

Due to ICTs importance in the society and possibly in the future of education, identifying the possible factors that influence integration of these technologies in schools would be an important step in improving the quality of teaching and learning (Bingimlas, 2009). Educators appreciate the value of ICTs but they are faced with a batch of difficulties as they try to adopt it in educational settings. A lot of research has been done to establish the factors that influence integration of technology in education (Bingimlas, (2009); BECTA, (2004); Afshari, Bakar, Luan, Samar, and Fool, (2009)).

2.3 ICT and Education in Kenya

Since Kenya gained independence, there have been remarkable initiatives to restructure the education system. The GOK is committed to provide quality education that will meet the needs of Kenyans. That is; education that would equip all learners for their social and economic responsibilities for the development of Kenya (MOEST, 2005).

Kenya is exploring the possibility of using ICT to transform the delivery of education. Literature reveals abundance of positive claims published in recent years about the promise that ICT holds in transforming education in the twenty-first century (Wang, 2009). ICT prepares students to participate in a rapidly changing world in which work and other activities are increasingly transformed by access to varied technology (Sharp et al, 2002). ICT provides support not for classroom activities, but for administrative activities as well (World Bank, 2003). The revolution of ICT sector undertaken by GOK is destined to change the way schools conduct their businesses (Ngugi, 2007). Use of ICT will help educators to enhance pedagogical practices that have been in place for many years. Kenya can borrow a leaf from countries that have succeeded in integrating ICT in their education system e.g. Singapore, Egypt, UK, and Australia. In those countries, implementation of ICT in education settings is controlled by central government agencies, and usually these agencies have national plans that are geared specifically to meet the economic demands of

globalization and social demands of the information age (Wang, 2009). Integration of ICT in schools especially in Africa is slow and uneven as indicated by table 2.1 below. It provides some estimates of numbers of schools reached with computers in a sample selection of African countries through NEPAD e-Schools project (Farrell and Shafika, 2007).

Table 2.1: Computer Penetration Ratios at Schools in Selected Africans Countries 2006

Country	Number of schools	Schools with computers	% of schools with computers
Egypt	26,000	26,000	100%
Ghana	32,000	800	2.5%
Mozambique	7,000	80	1.1%
Namibia	1,519	350	22.1%
South Africa	25,582	6,651	22.6%

The level of social, political and economic development in Africa has been slow compared to other countries in the world that have fully embraced use technology as tool of instructional delivery. This can be attributed by slow growth in the telecommunication sector which has direct impact on diffusion of technologies in education institutions as illustrated by table 2.1 above. Any meaningful development can only occur through provision of quality education (Mahapatra, 2005).

2.4 ICT policies

The point that future socio-economic development will need to embrace the use of ICT appears to be widely recognized by governments throughout Africa and is evidenced by the number of countries that have a national policy for ICT in place or under development (Farrell and Shafika, 2007). Table 2.2 below indicates how the development of these policies has progressed since turn of the millennium.

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Table 2.2: Development of National ICT Policies 2000-2007

Status of National ICT Policy Development by Country	2000	2005	2007
Policy in Place	13	28	36
Policy Underdevelopment	10	15	12
No Development Underway	30	10	5
Total	53	53	53

The policies vary in several ways. First, a few, often those that have been in place for some time, are more likely to focus on telecommunication technologies and their regulation, and less on the importance of information technologies for development (Farrell and Shafika, 2007).

Kriz and Qureshi (2009) came up with a model that views policy framework as a mediating factor in the relationship between ICT adoption and economic growth.
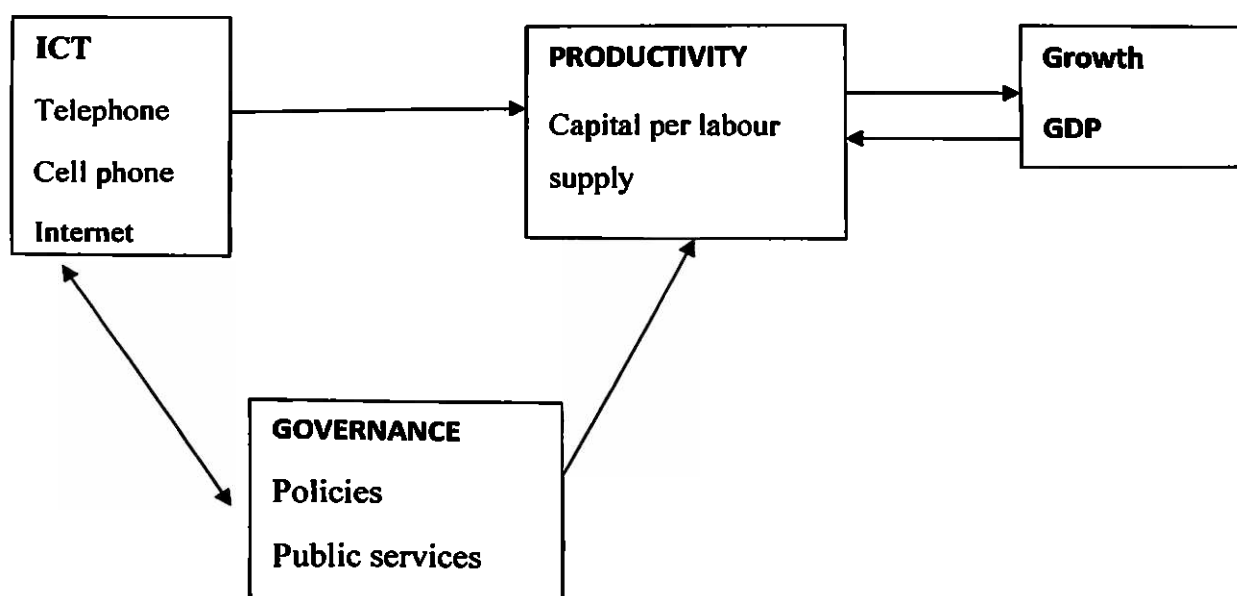
Figure 2.1: Model of the effects of ICT Adoption on Economic Growth.

The model suggests that ICTs lead to increase in productivity. Government policies and public services are the mediating factors which promote ICT adoption if implemented.

The GOK appreciates and recognizes that, an ICT literate workforce is the foundation on which Kenya can acquire its status of knowledge based economy (GOK, 2007). The education sector will, therefore, provide the skills that will be required to steer Kenyans to the economic and social goals of Vision 2030. Technology and innovation has been identified as a strategic area that will steer the country in realizing the ambitious vision. To achieve such an enterprise calls for a paradigm shift in education. ICT as a tool can provide a medium to achieve this. The Government of Kenya through the Ministry of Education has vital role to play in providing ICT infrastructure and professional development needed in schools.

Government policies are essential to facilitate change. Policies enable the integration of appropriate forms of ICT into education system (UNESCO, 2006). They are needed to bring out the benefits of information and communication technologies (ICTs). Benefits of ICTs lie in the opportunities it offers developing countries to learn innovative and create ICT-based jobs, products and services (World Bank, 2003). The report further states that ICTs policies should be tailored to realize these opportunities and therefore assists individuals and organizations to full participate in and contribute to global information society.

The GOK (2006) adopted and published a policy and strategy on information and communication technology. The aim is to improve the livelihoods of Kenyans by ensuring availability of accessible, efficient, reliable and affordable ICT services. The formulation of a national policy and strategy on the effective use of ICT in education aims to integrate ICT into education and training systems and to use it to promote and enable education reforms (Ngugi, 2007). Farrell (2009) outlines the objectives of the policy; create an e-enabled and knowledge-based society by 2015, facilitate training of teachers and students in ICT, promote ICT as a learning tool in the school curriculum at all levels, promote

distance education and virtual institutions, particularly in higher education, facilitate sharing of e-learning resources between institutions, promote establishment of a national ICT centre of excellence, and provide affordable infrastructures to facilitate e-learning.

2.5 Benefits of ICT

There are many benefits that will result from use of technology in teaching and learning. It will impact on the economy, business, investment, on food security, on poverty reduction, on productivity and competiveness of African economies (Birungi and Musoke, 2004). In education institutions, the following benefits can be realized

2.5.1 Improve quality of education.   UNIVERSITY OF NAIROCI
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ICTs in education extend and raise the quality of education and also imparting ICT skills to population in the workforce. Schools invest in information technology and systems because they assist in achieving the short and long-term goals. Access to training materials at any given time, an interactive learning portal which provide both learners and teachers with collaborative tools, and access to latest books editions and other information materials enhance learning methodology. Delay in adoption of ICTs will also delay in the meaningful participation of young people in the modern world.

2.5.2 Support administrative activities and decision making

ICT provides support not only for classroom activities but for administrative activities as well. Through ICT training programs, school principals and administrators learn how ICT can help improve the process and quality of administrative activities through management software and computer networks, including human resource management, students' registration and monitoring of students enrollment and achievement (World Bank, 2003). Information system and technologies are some of most important tools available to managers for achieving higher levels of efficiency and productivity in organizations

especially when coupled with changes in organization practices and management behaviors (Laudon and Laudon, 2006). In school settings, principals require right information at the right time to make informed decisions. This will prevent them from relying on guesses and luck that results in misallocation of resources, poor response and poor performance. Management of information system (MIS) is a vital tool that assists the school managers to perceive school challenges in the environment; they formulate strategies to respond to those challenges; and they allocate human and financial resources to coordinate the activities in order to achieve success. Throughout, they must exercise responsible leadership. Laudon and Laudon (2006) argue that one role of management responsibility is creative work fueled by new knowledge and information. IT when used effectively can aid the principals in re-creating and redesigning their schools.

2.6 Factors influencing ICT integration

Understanding on how ICT can be integrated in education is based on premises that the innovation and appropriate use of ICT can help reach those excluded from learning and improve the quality of learning and life for all (UNESCO, 2006). It is clear from research carried out around the world that ICTs infusion in education system is slow as a result of inappropriate approach in its integration. Roger (2003) cited in Richardson (2009) argues that instead of simply accepting or rejecting an innovation, potential adopters are on many occasions active participants in the adoption and infusion process, struggling to give meaning to the new ideas as the innovation is applied to their local context. The pressure is enormous for the education system to come to terms with new challenges and take full advantage of the ICTs. To mainstream ICTs in classroom, educators should address various factors that come their way in this endeavor. These factors include; time, issue of technical support, ICT infrastructure and access and teachers' ICT knowledge and skills. Other factors influencing ICT integration among schools that have been discussed widely

in literature include; attitude, level of confidence and administrative support (Mumtaz, (2000); Albirini, (2006); ChanLin, (2007); Grainger and Tolhurst, (2005); Teo, (2008); Gulbahar and Guven, (2008)). However, these factors were not studied during the research.

2.6.1 ICT Infrastructure and access

An important variable of ICTs integration in school is availability of ICT infrastructure and access. Using up-to-date hardware and software resources is a key feature to diffusion of technology (Gulbahar, 2005). The major use of ICTs constraints are inconsistent or unavailable supply of electricity, lack of ICT equipment, overcrowding of computer laboratories, and lack of affordable access to internet connectivity with acceptable bandwidth (UNESCO, 2007). Researchers' views funds to obtain the necessary hardware and software as one of the reason that affects teachers use technology in their classes. Funds are needed to maintain the computers, buys supplies and additional equipment and software to meet expanding demand, pay for monthly internet access fees, replace failed or outdated equipment, and possibly cover the salary of technical support specialists or instructor (UNESCO, 2007). The subscription and infrastructure costs coupled with poor quality service by service providers' impacts on the use of ICT in education (World Bank, 2003).

Today, a chronic paucity of affordable access to network infrastructure and services endures in all LDCs (UN, 2004). The report also cites quality infrastructure as a factor that influences use of computers and internets in developing countries. This is worsened by insufficient and unreliable electrical power in rural areas. Available infrastructure does not need to be state of the art but it must enable teachers to use prescribed TPD tools and resources effectively. It is the nature and flexibility of access, the issue being deployment and use of resources and not simply shortage (Tearle, 2007)

Infrastructural support for TPD extends to items such as classroom space and electrical power as well as the educational infrastructure of knowledge resources, curricular and assessment. Computer infrastructure is a fundamental factor facing ICT integration in school.

Appropriate access to technology infrastructure is another key factor in effective integration process. Inability of teachers' to gain access to ICT resources is factor that influences ICT integration in classroom. Access may be due to the way resources are organized (BECTA, 2004).

In another study, Mumtaz (2004) in BECTA (2004) points out that very good practice in the use of ICT invariably found in those schools that also have high quality ICT resources, and that lack of computer and software can seriously limit what teachers can do in the classroom with regard to implementation of ICT.

Farrell and Shafika (2007) indicate that development of ICT infrastructure comes with problem of e-waste-electronic or electrical equipment that has been discarded or has become obsolete. These include old end-of-life computers, cell phones TVs, and radios. Such equipment when donated to schools becomes a liability due to regular demand for constant upgrading and maintenance. Hardware, software and network infrastructure must be available to integrate ICT in education.

Appropriate resourcing and flexibility, forward-looking planning, linked closely to what teachers usually want and need at any give stage, will be essential. Therefore, efficient and effective use of technology depends on the availability of hardware and software and equity of access to resources by teachers, students and administrative staff.

2.6.2 Teacher's ICT knowledge and skills

Professional development of teachers sits at the heart of any successful technology and education. To use ICT as tool in teaching and learning, teachers needs visions of the technologies, potential opportunities to apply them, training and just-in-time support, and time to experiment (Jung, 2005). Graduate teachers should have the competence and confidence to use and model ICT tools for the purpose of administration, planning, teaching and learning. According to BECTA (2004) the issue of training is certainly complex because it is important to consider several components to ensure effectiveness of the training. These are time for training; pedagogical training, skills training and an ICT use in initial teacher training. Afshari et al (2009) reveal that teachers training programmes often focus more on basic literacy skills and less on the integrated use of ICT in teaching.

To maximize the effectiveness of ICT use in formal education contexts, teachers need more than just the requisite technical skills. The success of ICT use depends on teacher familiarity with good practices firmly rooted in an understanding of how learners learn (Norbert and Marilyn, 1999). According to Invers (2003) teacher education programs should integrate technology instruction into their pre-service programs. This helps new teachers understand how to use technology in their classroom. She notes that veteran teachers remain disadvantaged unless they have the support of their schools and government to further their own technology. Skills training should be geared toward teachers perceived needs and goals. Schofield (1995) underlined the need for provision of teacher training programs for both pre-service and in-service teachers. Modern developments have placed more demands on teachers to learn how to use new technologies through continuous retrain and acquire new knowledge and skills (Jung, 2005). He further notes that combining new technologies with effective pedagogy has become a daunting task for both initial training and in-service training instructions.

2.6.3 Technical support

Afshari et al (2009) indicate that technical support is a factor that determines the extent to which computers are utilized in classes. Teachers may fear to use computers because they are not sure where to turn to for help when something goes wrong while using computers. Yildirim, Yildirim and Goktas (2009) in their studies found technical support as one of the main factors that influences use of ICT in classroom. Availability and maintenance of infrastructure are only one aspect that will affect integration of ICT in teaching. Teachers need to be able to ask for support in order to ensure that equipment needed is in right location at the right time and ready for use, to solve technical problems, to be available when things go wrong, and to provide basic support for teachers trying to improve their knowledge, understanding and practical skills (Tearle, 2007)

Without good technical supports in both the classroom and whole school resources, teachers cannot be expected to overcome barriers preventing them from using ICT (Lewis, 2000 cited in Bingimlas (2009). These technical problems include; mal-functioning computers, failing to connect to internet, faulty printers, use of old computers. Technical support is deemed essential in many aspects of ICT use, including the use of particular software packages and in the use of learning management system for ICT- enhanced lesson. Besides insufficient training, educators frequently note that lack of technical support determines their use of technology (Invers, 2003).

2.6.4 Teachers' time

Working with ICTs is often difficult simply because ICTs are new and individual and social routines have to be established in using them (Yildrim et al, 2009). Modern technologies are not easy to grasp as traditional technologies were; many of which only required 'push the button' skills to operate. Anything to do with computer takes time.

Learning new skills in any profession require time. Teachers require time to experiment with new technology, share its experiences with others and attend technology related in-service training programs (BECTA, 2004). The report also indicates that, teachers require time for training. Therefore, teachers require ample time and opportunities to expand their knowledge to try out innovative methods, to exchange ideas with experts and their peers, and to refine their skills so they may respond more rapidly to new developments in their fields (Bingimlas, 2009). Most one-time workshops just teach teachers skills using a specific software program without demonstrating good and appropriate teaching strategies and without changing teachers' behaviours.

Teachers need enough time to practice and receive meaningful training using ICT across the curriculum. Time is fundamental if teachers are to learn computer basics, plan how to integrate technology into their lessons, and actually use technology in classrooms. Teachers don't mind taking time to create materials or learning new tools, yet teaching load, service and research take time.

Great deal of time is required to prepare ICT materials for use by children with range of abilities. Therefore, teachers require time to explore materials for use by such children. They require sufficient time to preview web sites, prepare multimedia materials, for lessons and undertake training (Grainger and Tolhurst, 2005). Time is required to locate internet advice, for preparation of lessons and resources, to explore and practice using the technology, to deal with technical problems and receive adequate training.

Time scheduled on timetable to use computers with students is a factor. Enough time should be allocated on the timetable for students to use computers. Time is crucial for successful integration of technology into the curriculum (Afshari et al, 2009).

Teachers may have confidence and competence in using computers in the classroom, but they may still make little use of technologies because they do not have enough time (Bingimlas, 2009). Time affects ability of teachers to complete tasks. Teachers require time to design projects that include the use of new ICT than to prepare traditional lessons.

2.7 ICT integration in teaching and learning

Integration of ICTs enhances the quality of education by helping teachers to do their job and by helping students learn more effectively. Moreover, with the rapid growth of innovation technologies, teachers need to keep abreast of technological innovation so that they can know where to retrieve information and obtain resources and tools.

The use of information and communication technology create a powerful learning environment and it transforms learning and teaching process in which students deal with knowledge in active , self directed and constructive way (Afshari et al, 2009)

ICTs as a tool, supports new ways of teaching and learning. It assists student to develop skills for cooperation, communication, problem solving and lifelong learning. Technology as a tool supports the educational objectives such as skills for searching and assessing information, cooperation, communication and problem solving which are important for the preparation of children for the knowledge society.

ICTs play various roles in learning and teaching process. It has great potential to enhance student achievement and teacher learning. It can support face-to-face teaching and learning in the classroom (Bingimlas, 2009). ICT may not be optimized if there is no shift in the learning and teaching paradigm. New technologies can help teachers and enhance their pedagogical practices and assist students in learning.

It expands the pedagogical resources available to teachers. ICT increase students' awareness of the world around them, of citizenship and of a scientifically literate

community. As a tool it enhances science teaching and learning in schools. These include data capture, multimedia software for simulations, publishing and presentation tools, digital recording equipment, computer projection technology, and computer-controlled microscopes (MOEST, 2005)

Figure 2.2 below represents a conceptual framework.

Independent variables   **Dependent variable**

ICT infrastructure and access

- Internet connectivity.
- Computers
- Budget on ICT infrastructure
- Types of ICT programs used.
- Rate of access to ICTs.

ICT knowledge and skills

- Training in ICT
- ICT programs learned.
- Budget on staff development.

Technical support

- ICT technician/media Specialist.
- Budget on maintenance and upgrading.

Time

- Release time
- Scheduled time
- Teaching load
- Training

ICT integration in teaching and learning

- Technology integrated lessons.
- Use of computer for administrative work.
- Change in pedagogical practices.

Government policy on ICT

Moderating variable

Figure 2.2 Conceptual Framework

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2.8 Conceptual Framework

Integration of ICT in education is based on the premise that it will improve quality in teaching and learning. Successful integration of ICTs in education requires proper understanding of factors that influence it. The following section discusses how these factors mediated by government policies on ICT, impact on ICT adoption in teaching and learning.

Availability and accessibility of ICT infrastructure in educational setting is paramount to their efficient and productive use. These include; hardware, software, internet connectivity and power supply. Structural arrangement of the ICT infrastructure can further influence their accessibility.

Successful adoption of ICT requires continuous professional development. Teachers' training program in both in-service and pre-service training should focus on teaching with technology rather that teaching about technology. Training should be based on educational goals teachers want to achieve with help of ICT.

To use computers in their activities, teachers need assurance of technical support in case a problem arises. This can be achieved by putting in place a plan for maintaining and upgrading classroom technology, and staff training to ensure timely responses to technology break down. This is possible through allocation funds to cater for ICT programs.

Availability of time is vital to ICT adoption. Teachers require adequate release and scheduled time to practice using computers in classes and to use computers with students. Availability of time is dependent on teaching loads; a product of rigid and overloaded curriculum.

The above factors are mediated by policies which promote ICT adoption if well implemented followed by good monitoring and evaluation mechanisms.

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2.9 Summary

ICTs can empower local groups by allowing marginalized communities to benefit and contribute to global knowledge. ICTs can liberate marginalized societies from information poverty creating opportunities for them to become empowered and become productive in the knowledge economy. Therefore gaining understanding on how ICTs are assimilated in educational settings will enlighten policy makers, government and other shareholders to develop more successful ways to infuse technologies in classroom. Understanding what motivate and inhibits and users' choice to adopt ICT innovations is vital for future undertakings

CHAPTER THREE

RESEARCH METHODOLOGY

3.1. Introduction

This chapter explores the research design used in the study, study location, population target, sampling procedure, and methods of data collection, validity, reliability and operational definition of variables.

3.2 Research design

Descriptive survey design was used with mixed-method approach being applied to assess the factors influencing integration of ICT. The researcher used both quantitative and qualitative research approach in the data collection and analysis process. The research aimed at collecting opinions from teachers and principals, about factors influencing adoption of ICT in teaching and learning environment. Both primary and secondary data was gathered. Primary data was obtained using questionnaires, observation and interview schedules. Secondary data was acquired from internet, journals and relevant books.

3.3 Target population

Mathioya district is located in Central Province, Kenya, created from the larger Murang'a District. It is a rural area with 29 secondary schools out which three are provincial boarding schools and the rest are day and boarding district schools.

The study targeted the school principals and teachers in the sampled schools. The respondents were mainly those teachers who have gone through a teacher education program. Data from 52 teachers was collected by use of questionnaires and four principals were interviewed giving a total of 56 participants

3.4 Sampling Design and Sampling procedure

Probability sampling design was used. A sample population was chosen to represent the relevant attributes of the whole target population. A list of all schools was compiled from the district education office. According to Mugenda and Mugenda (1998), for descriptive study 10% of accessible population is enough. Mathioya District has twenty nine schools. Five of them are upcoming schools and were not included in the study. This is because they did not have adequate trained teachers. The study was meant to gather information from teachers who have gone through teacher education. Accessible population of twenty four schools was used to determine the sample size of thirteen schools. Stratified random sampling was applied to determine the representative sample. The schools were divided into two subgroups; Provincial and District schools. All provincial schools were included in the sample owing to their small number. Then random sampling was applied to determine the number of schools to be included from the district schools. The same method was applied to determine the principals to be interviewed from district and provincial schools. Table 3.1 below shows the distribution of the respondents used.

Table 3.1 Distribution of respondents

Schools/principal	Number of schools/principals	Number of respondents
Provincial schools	3	12
District schools	10	40
Principals	13	4
Total		**56**

From each school, four teachers were selected: one teacher from each department: science, languages, humanities and applied sciences department. One principal from provincial schools and three from district schools were interviewed.

3.5 Methods of data collection

The study employed survey method of data collection. The data was collected using self administered questionnaires with open-ended and close ended questions, observation, and semi-structured interviews. Items in all of them were grouped around six major topics: Respondent profile, integration of ICT in teaching and learning, ICT infrastructure and access, ICT knowledge and skills, technical support, and teachers' time. Questionnaires consisted of open-ended and closed-ended items designed as Likert-type statements, to which respondents responded with a rating of 1-5 (5 indicating strongly agree, 4 indicating agree, 3 indicating neutral, 2 indicating disagree, and 1 indicating strongly disagree). The mid-point value of the index used was hundred and sixty five as hypothesized mean (Coakes and Steed, 2001). Therefore, any result that that differed from the hypothesized mean was considered to be either positive or negative to the concept being tested.

The researcher carried out the data collection process. The respondents were reached in their schools. The researcher convened sessions of interview with each school principal, and administered questionnaires to teachers. The questionnaires that were used in the study were adopted because they could gather large amount of data in a cost effective manner. The instruments allowed respondents to take time and give well thought out answers. Structured observation was used to assert physical presence of computers, programs installed and internet connectivity. The semi-structured interviews with principals were meant to obtain in-depth information about ICT use. The information gathered from interviews include: budget on ICT, training and culture on ICT use in schools

3.6 Validity and reliability

Reliability refers to the accuracy and precision of a measurement procedure. The test-retest method of assessing reliability was used. Pilot testing of the research instruments

was done in five schools that were not included in the sample. The process was repeated after two weeks, to examine consistency of response between the two tests to ensure that they test relevant variables.

Validity refers to extent to which an instrument measures what the researcher actually wishes to measure. The variables and data collection instruments were scrutinized by experts, mainly the University Supervisor for their expert opinion to ensure that they were in line with the objectives. Further scrutiny of the instruments was carried out by peers and experienced researchers. The researcher used different sources of data and approaches to strengthen the validity of the results.

3.7 Operational definition of variables

Table 3.2 below indicates how variables were measured. Actual and concrete measurement techniques were used in order to give desired results and eliminate subjectivity.

Table 3.2: Operational definition of variables

Objectives	Variable	Indicator	Measure	Scale	Tools of analysis	Type of analysis
To establish the extent to which ICT is integrated in teaching and learning	**Dependent** ICT integration in teaching and learning	Technology integrated lessons	Rate of computer use in instructional delivery	Ordinal	Median	Descriptive
		Change in pedagogical practices	-Rate of textbook use as primary guide for instruction.	Ordinal	Median	Descriptive
			-Number of tasks learners undertake using computers	Ordinal	Median	Descriptive
		Use of computer for administrative work.	-Number of tasks done by computers	Ordinal	Median	Descriptive
To determine the influence of ICT infrastructure and access	**Independent** ICT Infrastructure and access.	Computers	Number of computers	Scale	Mean	Descriptive
		Types of ICT programs	-Number of programs	Ordinal	Median	Descriptive
			-List of programs	Ordinal	Median	Descriptive

on integration of ICT in teaching and learning		Internet connectivity	Number of computers connected to internet	Ordinal	Median	Descriptive
		Access to computers	Rate of access to computers	Ordinal	Median	Descriptive
		Electricity supply	Rate of consistency in power supply.	Ordinal	Median	Descriptive
		Budget	Amount of money allocated to purchasing hardware and software	Ordinal	Median	Descriptive
To determine the influence of the teachers' ICT knowledge and skills in integration of ICT in teaching and learning.	ICT knowledge and skills.	Training in ICT	-Number of teachers trained on ICT -Number of ICT In-service training programs attended	Ordinal	Median	Descriptive
		Type of ICT programs learned	List of programs learned.	Ordinal	Median	Descriptive
		Budget on staff development	Amount spent on staff development	Ordinal	Median	Descriptive
		Types of tasks completed using computer	Number of tasks completed using computer	Ordinal	Median	Descriptive
To establish the extent to which technical support influence ICT integration in teaching and learning	Technical support	Trained personnel	-Number of technicians/ media specialists - Number of trained teachers	Scale / Scale	Mean / Mean	Descriptive / Descriptive
		Budget	Amount spent or budget on computers maintenance and training.	Ordinal	Median	Descriptive
		Computer and technology breakdown.	Rate of computers break down	Ordinal	Median	Descriptive
To establish the influence of teachers' time on integration of ICT in teaching and learning.	Teachers' time	Release time	Average number of free lessons per day.	Scale	Mean	Descriptive
		Scheduled time	Average number of lessons per day	Scale	Mean	Descriptive
		Social-cultural support	Number of seminars attended on ICT	Ordinal	Median	Descriptive
		Real world experience	Rate of interaction with ICT experts/mentor teachers	Ordinal	Median	Descriptive

3.8. Data Analysis and Techniques

Descriptive analysis was used to analyze the data gathered in each variable. The data was coded manually and prepared for analysis using the statistical analysis software SPSS 11.5. Means, frequencies, percentages, mean score ranking and the importance index and standard deviations of the questionnaires items were calculated. The data obtained from qualitative responses was analyzed by means of content analysis. The data was organized under pre-identified categories and themes. Data from open-ended items from questionnaires were coded and organized according to these themes.

3.9 Ethical issues

An informed consent was sought from all respondents. The researcher gave full and detailed explanation of the study. The respondents were made aware of voluntary participation and the information collected would be made confidential and used for the purpose of study only. They were free to ask questions and clarifications before filling the questionnaires. The respondents were not supposed to write their names on the questionnaire. Instead they were assigned a code so that if the researcher needed more information, he could contact the respondents. No threats or victimization was used if respondent declined to participate or withdrew from the study.

3.10 Summary

The study utilized descriptive survey design with qualitative and quantitative approach. The data was collected by use of questionnaires, interviews, and observation method. A target population of 56 respondents was used out of which 52 were teachers and four principals. Stratified random sampling was used to select schools and participants who took part in the study. Four teachers each representing the following departments were issued with questionnaires: science, humanities, languages, and applied sciences. Data from each variable was coded and analyzed by use of a computer program (SPSS 11.5).

Descriptive analysis was used to analyze data gathered from each variable. The researcher sought consent from respondents before collecting data and explained to them that all information they were to give would remain confidential and will be used for academic purposes only.

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND INTERPRETATION

4.1 Introduction

The findings of the study were analyzed and presented in the chapter with respect to respondents' profile, and factors that influence the adoption of ICT in teaching and learning which are; ICT infrastructure and access, ICTs knowledge and skills, technical support, and teachers' time, and integration of ICT in teaching and learning.

4.2 Response rate

The questionnaires were given to fifty two teachers. Table 4.1 below indicate survey completion rate.

Table 4.1 Survey Return Rate

Gender	Number of teachers issued with survey	Number of surveys retrieved	Return rate
Male	34	33	97
Female	18	18	100
Total	52	51	98.5

The researcher set out to interview four principals with a response rate of 100%. Completed surveys were received from fifty one respondents of whom 33 were male and 18 female. This represents a response rate of 98.5%. From each school, one teacher from each department was issued with a questionnaire. These departments were sciences, languages, humanities and applied sciences. This was based on the principle that teachers have different perspectives in technology integration. Their attitudes and beliefs towards technology integration are bent by knowledge and skills acquired during pre-service and in-service training and experiences they undergo during professional practices.

4.3 Respondents' profile

Mathioya District has twenty nine schools; three provincial schools and twenty six district schools. The study targeted a sample size of fifty six respondents derived from both provincial and district schools within Mathioya District. Table 4.2 below shows the respondents' profiles by their years of experience as teacher.

Table 4.2 Years of experience as a teacher

	Respondents	Percent	Cumulative percent
Less than 5 years	16	31.4	31.4
6 – 10 years	17	37.2	68.6
11 – 15years	8	15.7	84.3
More than 15 years	8	15.7	100
Total	51	100	

Among the fifty six respondents, 64.7% were male and 35.3% female. 68.6% have been in profession for more than six years, and were therefore familiar with pedagogical approaches and practices. Hence they were considered as well placed to provide useful data for the survey

4.4 Factors influencing integration of ICT in teaching and learning

The questions used in both surveys and interviews were aimed at addressing factors that influence teachers' use of ICT in teaching and learning. The results are organized into the following sub-sections: ICT integration in teaching and learning, ICT infrastructure and access, ICT knowledge and skills, technical support, and teachers' time.

ICT Infrastructure and access was measured through interview, open ended and close ended questions, and observation. The results showed that a relatively high percentage of respondents 54.9 % had computers at home. All schools under the study had computer (s) with mean rate of 14.76 and standard deviation of 13.38. The mean and the standard deviation were calculated from finding out that the minimum number of computers in the

schools in which the study was carried out was one while the maximum number was 40. The survey found out that in all schools where the study was carried out, none had computers in the classroom and only two schools had a computer in the staffroom. Table 4.3 below shows the location of computers in sampled schools.

Table 4.3 Location of computers

Location	Schools	Percent	Cumulative percent
Computer Lab	8	61.5	61.5
Classroom	0	0	61.5
Staffroom	3	23.1	84.6
Computer Lab & Staffroom	2	15.4	100
Total	13	100	

The figures in the above table can be used to explain why only small percentage of teachers (25.5%) use computers always, often (45.1%), and rarely (29.4%). The teachers whose schools have computer laboratory were asked to indicate how often they make use of it. Those who said they use it daily (25%), weekly (25%) monthly (12.5%), less than once per month (25%), never (12.5%). Further investigation revealed that, only 18.8% of teachers use computer laboratory for classroom presentation. Table 4.4 below indicates the types of programs commonly used in schools.

Table 4.4 Types of programs used

Programs	Responses	Percent	Percent of cases
Word processing	39	41.94	76.47
PowerPoint	10	10.75	19.61
Publisher	10	10.75	19.61
Excel	26	27.96	51.98
Database	8	8.60	15.69
Total	93	100	182.36

From table 4.4 above, the most common types of computer programs used in schools are Word processing with response rate of 76.47% followed by Excel (51.98%), PowerPoint and Publisher each with a response rate of 19.61%. Other programs that were familiar with participants and classified under others during the research include software for analyzing grades and Encarta Encyclopedia.

The survey and interviews revealed limited experience on training in the use of ICT. Majority of those teachers, who use computers, portrays inadequate training on computer use in both pre-service and in-service training. Those who use computers possess basic skills of using ICT equipments. Table 4.5 below shows tasks undertaken by teachers by use of a computer.

Table 4.5 Task undertaken using computers.

Tasks	Responses	Percent	Percent of cases
Classroom presentation	6	7.41	11.76
Create instructional materials	16	19.75	31.37
Administrative records keeping	21	25.92	41.18
Play games	10	12.35	19.61
Type letters and other documents	28	34.57	54.90
Total	81	100	158.82

There is limited penetration of national physical telecommunication infrastructure into the rural areas. Internet connection reported by 39.2% of the respondents is through personal broadband modems. Due to inadequate computers in schools, most teachers access internet from their homes. Therefore, the internet use is limited to communication with family/friends as reported by 29.4% of the respondents as indicated by table 4.6 below, search for information on topic of personal interest (39.2%), and use of internet to retrieve information that can be used in classroom (39.2%).

Table 4.6 Use of Internet

Internet uses	Responses	Percent	Percent of cases
Communicate with family/Friends	15	26.32	29.41
Communicate with other teachers or students on school related matters	2	3.51	3.92
Search for information on topic of personal interest	20	35.09	39.23
Search for information and content for lessons	12	21.05	23.53
Retrieve research and best practices for teaching/learning	7	12.28	13.73
Retrieve model lesson plan	1	1.75	1.96
Total	57	100	111.78

The study found out that the mean number of lessons and free lessons per day was 5.27 and 3.75 lessons respectively. The standard deviations were 0.94 and 0.956 respectively. The mean was found from findings that the minimum number of lessons per day was three and maximum number of lessons per day was six.

4.4.1 ICT Infrastructure and access

The participants used a five-point Likert scale (i.e. 5=strongly agree, 4=agree, 3=uncertain, 2=disagree, 1=strongly disagree) to rate their level of agreement on 7 statements about integration of ICT. This is illustrated by table 4.7 below.

Table 4.7 Influence of ICT infrastructure and access

Factors	SA	A	U	D	SD
Number of computers	67.7	29.4	2.0	3.9	2.0
Internet connectivity	43.1	45.1	7.8	3.9	0.0
Access to computer	33.3	49.0	7.8	7.8	2.0
Power supply	11.8	39.2	11.8	31.4	5.9
Cost of hardware & software	43.1	47.1	3.9	5.9	0.0
Availability of appropriate software	19.6	49.0	5.9	21.6	3.9
Structural arrangement of ICT infrastructure	19.6	41.2	27.5	11.8	0.0
State & quality of computers	27.5	37.3	2.0	27.5	5.9

Most teachers felt that infrastructure and their accessibility is vital to integration of ICT. Figure 4.1 below shows analysis of their responses; number of computers (97.5%), cost of hardware and software (90.2%), internet connectivity (88.2%), access to computer (82.3%), availability of appropriate software (68.6%), structural arrangement of ICT infrastructure (60.8%), and power supply (51.0%). Observation revealed that all school had constant power supply hence low level of agreement of 51%.
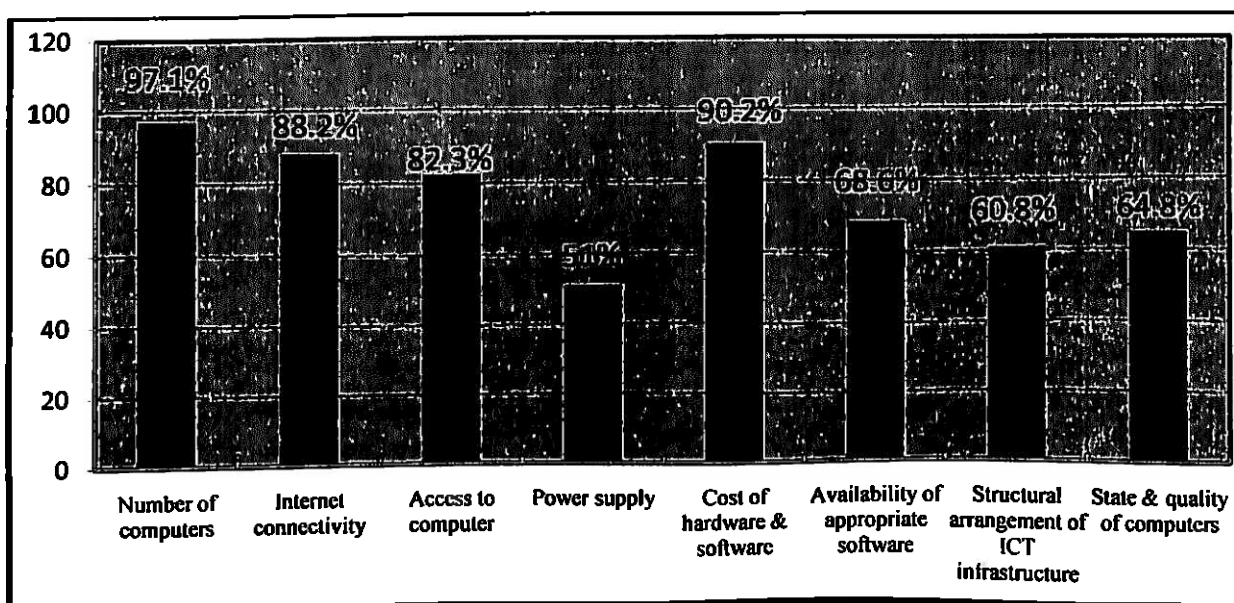
Figure 4.1 Influence of ICT infrastructure and access on ICT adoption

The principals who were interviewed claimed that lack of funds to purchase new technologies act as a barrier to acquisition of ICT infrastructure. In schools where there was adequate number of computers, interviewee's criticized the government initiatives to equip schools with technologies without providing appropriate software and curriculum that incorporate ICT. The interview also revealed that pre-conditions that are demanded by most institutions before they donate computers to schools are too expensive to some schools. The school must have a well secured computer laboratory due to high levels of insecurity in the area.

4.4.2 ICT knowledge and skills

The participants used a five point Likert scale to (i.e.5=strongly agree, 4=agree, 3=uncertain, 2=disagree, and 1=strongly disagree) to specify their perceptions on 5 statements about the influence of ICT knowledge and skills and technologies integration. Table 4.8 below illustrates their responses.

Table 4.8 Influence of ICT knowledge and skills

Factors	SA	A	U	D	SD
Finance to train staff on use of ICT programs	39.2	35.3	2.0	23.5	0.0
Amount of pre-service training on use of ICT	43.1	49.0	3.9	3.9	0.0
Amount of in-service training on use of ICT	47.1	49.0	2.0	2.0	0.0
Time to train staff on ICT	13.7	23.5	11.8	45.1	5.9
Familiarity with good practices rooted on understanding on how learners learn	21.6	43.1	17.6	15.7	2.0
Students skills on how to use computers	27.5	31.4	11.8	17.6	11.8

The results showed that, issues of training are complex because they are influenced by various factors. Participants rated the factors as follows; availability of funds to train staff (74.5%), pre-service training on use of ICT (92.5%), in-service training on use of ICT (96.1%), training on good practices based on understanding on how learners learn

40

(64.7%), and students' skills on how to use computers (58.9%). Figure 4.2 below shows percentage agreements on influence of ICT knowledge and skills in teaching and learning.
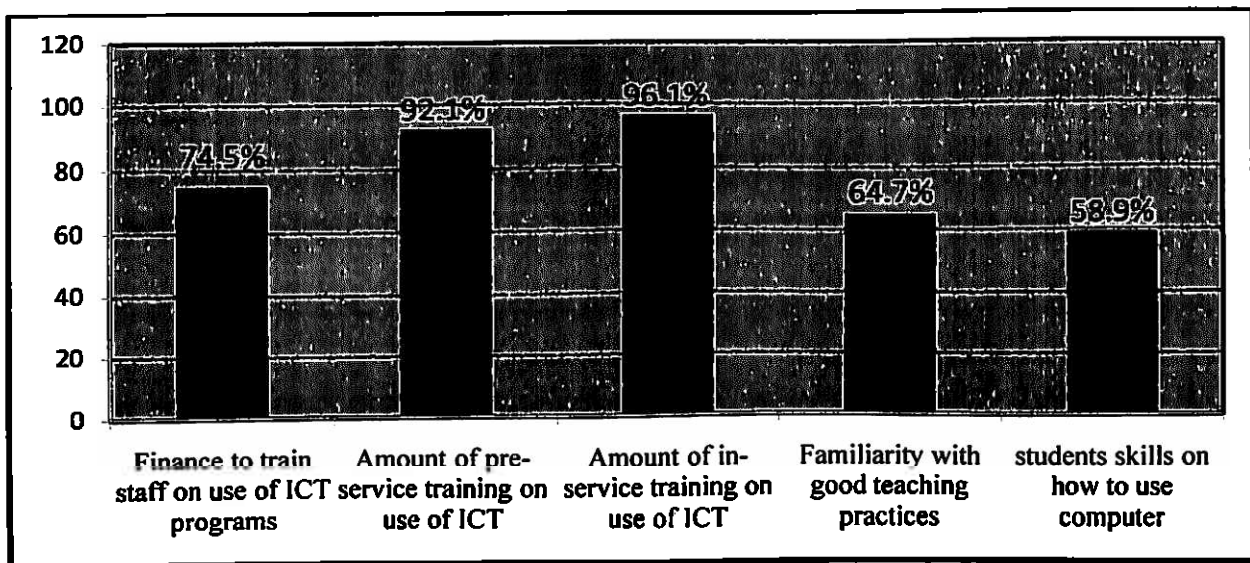
Figure 4.2 Influence of ICT knowledge and skills on ICT adoption

Interview revealed that effort to integrate ICT in schools is hampered by lack of in-service training bearing in mind that technology is highly dynamic. Principals were in agreement that teachers should be trained and retrained in ICT literacy, and also in pedagogy. There has been no seminar or workshop on ICT integration in teaching and learning conducted in the district for the last two years. Due to unavailability of funds and experts, schools cannot organize in-house training for their staffs on ICT use.

4.4.3 Technical support

The respondents were asked to indicate their level of agreement on influence of technical support in teaching and learning and learning using computers. The participant used five-point Likert scale (i.e. 5=strongly agree, 4=agree 3=uncertain, 2=disagree, and 1= strongly disagree). Analysis of their responses is illustrated in the table 4.9 below.

Table 4.9 Influence of technical support

Factors	SA	A	U	D	SD
Availability of technician or media specialist	45.1	37.3	3.9	13.7	0.0
Cost of computer maintenance and upgrading	31.4	51.0	7.8	9.8	0.0
Cost of engaging computer expert	31.4	45.1	11.8	9.8	2.0
Staff training on computer maintenance	33.3	52.9	3.9	9.8	0.0
Break down of computers & and other digital equipment	3.9	39.2	9.8	41.2	5.9

Figure 4.3 below shows analysis of their responses. Availability of technician or media specialist (82.4%), cost of computer maintenance and upgrading (82.4%), cost of engaging computer expert (76.5%), staff training on computer maintenance (86.2%), break down of computers and other digital equipment during teaching process (43.1%)
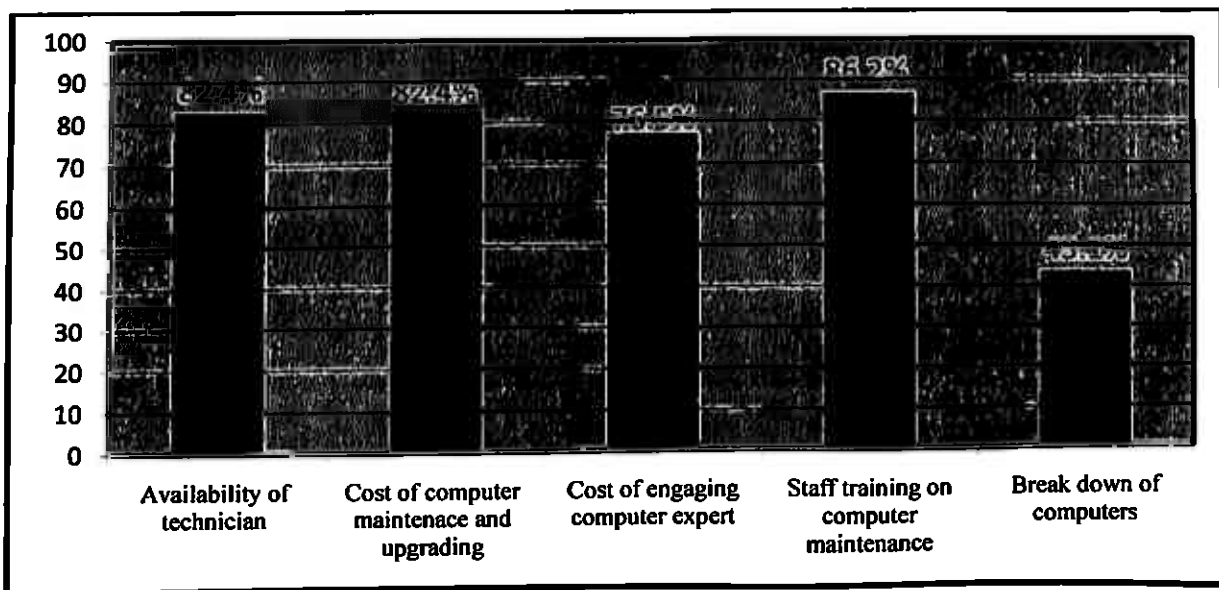
Figure 4.3 Influence of technical support on ICT adoption

The Principals who were interviewed affirmed that availability of technical support can ensure that ICT infrastructure is in good working conditions. This can mitigate frequent technology breakdown. Technicians can train teachers on basic troubleshooting skills which raise teachers' confidence. But due high cost of engaging ICT experts, many

schools employ ICT teachers who teach computer studies to a selected number of students and manages ICT infrastructure.

4.4.4 Teachers' time

The participants used five-point Likert scale (i.e. 5=strongly agree, 4=agree, 3=uncertain, 2=disagree, and 1=strongly disagree) to indicate the degree to which they agree on influence of teachers' time on ICT integration in teaching and learning. Table 4.11 below indicates analysis of their responses.

Table 4.10 Influence of teachers' time

Factors	SA	A	U	D	SD
Time to research and prepare digital materials for use in class	27.5	47.1	2.0	21.6	2.0
Scheduled time for teachers to practice using computers with students	33.3	51.0	7.8	3.9	3.9
Time & opportunities to interact & share experience of using new technology with peers	17.6	60.8	11.8	7.8	2.0
Time for training and exchange ideas with experts on how to use new technologies	23.5	56.9	7.8	9.8	2.0

Figure 4.4 below shows analysis of their responses using percentage level of agreement. Time to research and prepare digital materials for use in class (74.5%), scheduled time for teachers to practice using computers with students (84.3%), time and opportunities to interact and share experience of using new technologies with peers (78.4%), and time to training and exchange ideas with experts on how to use new technologies (80.4%).
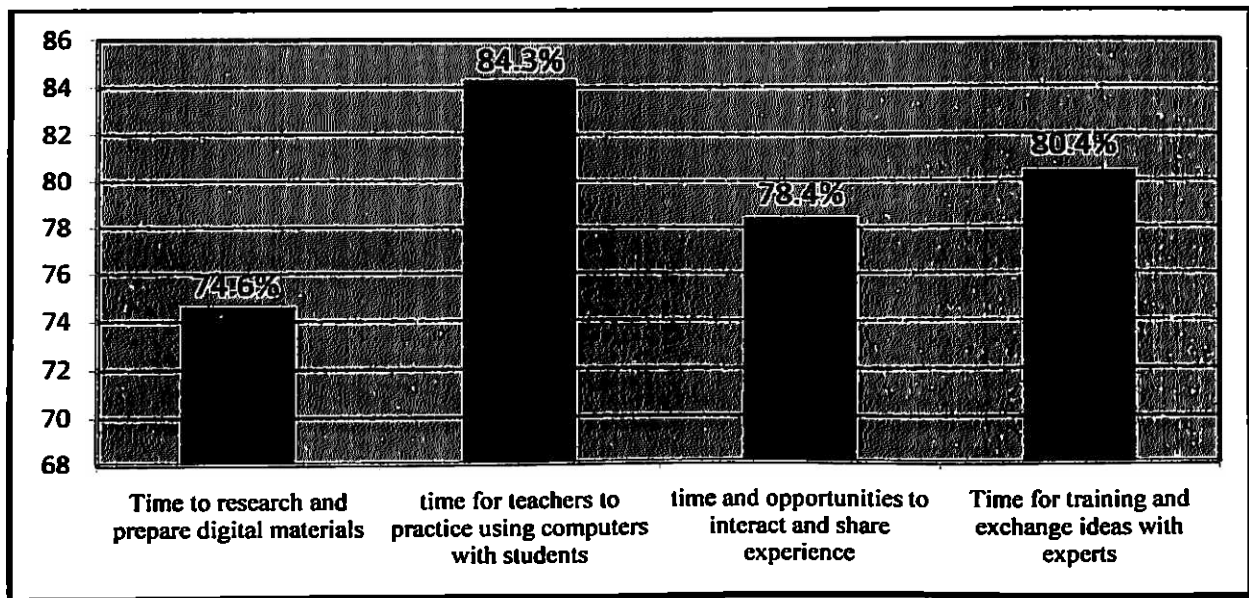
Figure 4.4 Influence of teachers' time on ICT adoption

The above findings were strengthened during interviews where majority of participants voiced their views that rigid curriculum and huge teaching load deprive teachers' time and opportunities to practice using computers in classroom. Many teachers prefer traditional methods of instructional delivery. According to them, traditional methods are less time consuming compared to preparation of digital materials for use in classroom.

4.5 ICT integration in teaching and learning

Participants were asked to respond to six statements about impact of ICT in teaching and learning. They used five-point Likert scale (i.e. 5=strongly agree, 4=agree, 3=uncertain, 2=disagree, 1=strongly disagree). Their responses are illustrated in the table 4.11 below.

Table 4.11 Impact of ICT in teaching and learning

Impacts	SA	A	U	D	SD
Increases staff use of generic applications	13.7	56.9	15.7	13.7	0.0
Increased resources	21.6	51.0	11.8	13.7	2.0
Improved presentation of work	17.6	51.0	19.6	11.8	0.0
Student use of multimedia technology	13.7	39.2	17.6	21.6	7.8
Provision of professional support through internet	21.6	41.2	21.6	13.7	2.0
Improve productivity	19.6	66.7	9.8	3.9	0.0

The survey explored a variety of benefits that can be achieved through use of technology in schools with the results showing that 70.6% agreed that ICT can increase staff use of generic applications, increased resources (72.6%), improved presentation (68.8%), students' use of multimedia technology (52.9%), and improve productivity (86.3). Figure 4.5 below shows the percentage agreement on impacts of ICT in teaching and learning.
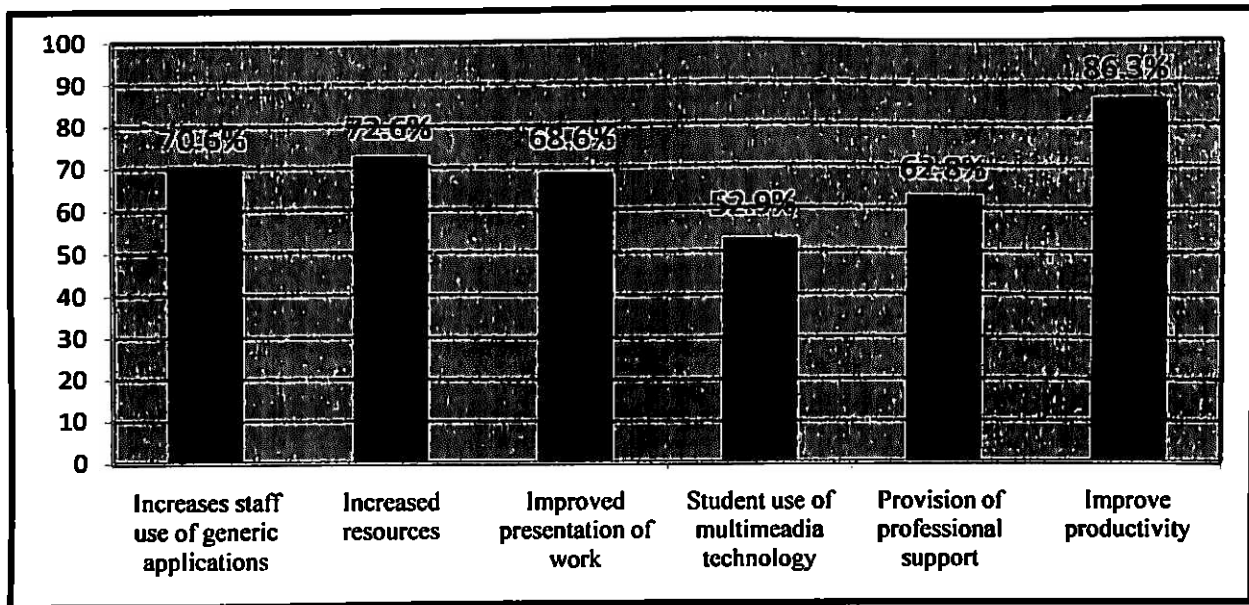
Figure 4.5 Impact of ICT in teaching and learning

From the interview, principals were in agreement that ICT can bring enormous benefits if used as tool of instructional delivery. They noted that ICT supports new ways of teaching and learning. Students develop skills for cooperation, communication, and problem solving. Use of ICTs makes administration more efficient. Teachers spend less time in administrative tasks which leave them with more time for teaching and preparing materials for use in classroom. With recent increase in students' population, ICT can be used as a tool for classroom management which is important for large class size. Integration of ICT can effectively address disparities in provision of quality education in the face of scarce financial, physical and human resources.

4.6 Summary

The chapter explored survey return rate which was 98.5%, the respondents' profile in terms of gender and years of experience, factors that influence integration of ICT in teaching and learning such as infrastructure and access, ICT knowledge and skills, technical support and teachers' time were analyzed. The information on the above factors was collected by use of questionnaires, interview and observation. The questionnaire used a five-point Likert scale to measure a range of opinions from "strongly agree" to "strongly disagree". Semi-structured personal interviews were used to collect data on the above factors from secondary school principals to supplement the questionnaires. Observation was done to ascertain physical presence of computers and internet connectivity, ICT programs, and availability of power supply.

Descriptive analysis of the data was done in terms of means, standard deviation, frequencies, percentages, and mean score ranking and importance index and presented in form of tables and figures. Data from interviews was organized in terms of themes.

CHAPTER FIVE

SUMMARY, DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The findings from the research indicate that the level of ICT infrastructure is relatively high in some schools but the degree of integration of those technologies in teaching and learning is inadequate due to variety of factors. The participants identified the following as factors that influence use of ICT teaching and learning; ICT infrastructure and access, ICT knowledge and skills, technical support, and teachers' time.

5.2 Summary of findings

The researcher found out that the schools had an average of 14 computers. Some schools had only one computer while others had as many as 40 computers. Only 8 schools out 13 that were sampled for the study had a computer laboratory. In those schools the minimum number of computers was 10 and a maximum of 40. None of the schools had computers in the classroom and only 3 had computers in the staffroom.

The types of programs used in almost all schools were document presentation programs such as Word processing and Excel with 76.47% and 51.98% rate of use respectively. Others that were used include PowerPoint, Publisher and Database.

The rate of computer access by teachers was noted to be as less as 25.5% for those who always use computers in their daily activities, while 29.4% rarely access computers. Computers were mainly used for typing letters and other documents as reported by 34.6% of the participant. Only 7.41% use it in classroom presentation. Other uses indicated by respondents include; creation of instructional materials and preparing assignments and tests, administrative record/keeping and playing games

The study also explored the rate of use of computer laboratory with 25% of participant reporting to use it daily, weekly (25%), monthly (12.5%), less than once per month (25%) and 12.5% said they had never used it.

All the schools that took part in the study had no internet connectivity. Those who reported to access internet (39.2%) do so through personal broadband modems. 35% of participant use internet to search for information on topics of personal interest. This was followed by use of internet to communicate with family/friends (26.32%). Search for information and content for lessons was reported by 21.05% of the respondents with only one participant using internet to retrieve model lesson.

The mean number of lesson per day was found to be 5.27. The minimum number of lessons recorded was three and a maximum of seven. The average number of free lesson per day was found to be four.

5.2.1 Factors influencing ICT integration in teaching and learning

The researcher set out to establish factors influencing integration of ICT in teaching and learning in secondary schools in terms of ICT infrastructure and access, ICT knowledge and skills, technical support and teachers' time.

5.2.1.1 ICT infrastructure and access

From the findings, majority of teachers strongly agreed that number of computers is crucial to ICT integration with a summated scale of 338, cost of hardware and software, internet connectivity and access to computer had an agreement level of 216 each. The study found out that other factors are; availability of appropriate software, state and quality of computers and structural arrangement of ICT equipment do influence access and use of technology. Power supply was rated low with 157 as level of agreement.

5.2.1.2 ICT knowledge and skills

The researcher found out that in-service and pre-service training on ICT use highly influence technology adoption by teachers with high agreement level of 216 and 236 respectively. Others such as finance to train staff on use of ICT, teachers understanding of good practices rooted on how learners learn and student skills on how to use computers were also noted. Only 37.2% of participants were in agreement that time to train them on use of ICT would influence technology use in class.

5.2.1.3 Technical support

The researcher found out that cost of computer maintenance and upgrading, staff training on computer maintenance and availability of technician do affect adoption of ICT in educational setting with agreement level of 204, 188 and 180 respectively. It was also found out that cost of engaging computer expert has an influence on ICT use in teaching and learning. However, breakdown of computers and other digital equipment was noted to have less influence with an agreement level of only 157.

5.2.1.4 Teachers' time

Time and opportunities to interact and share experience of using new technology with peers, scheduled time for teachers to practice using computers with students do influence the use of ICT with agreement level of 243 and 204 respectively. Findings indicated that training and exchanging ideas with experts on how to use new technologies determine use technologies in class. Participants also agreed that time to research and prepare digital materials for classroom use do influence computer use in teaching and learning.

5.2.2 ICT integration in teaching and learning

Majority of participants felt that use of ICT in educational environment improve productivity with an agreement level of 267. It was also found out that ICT increases availability of resources; improve work presentation, support professional development

and increases teachers use of generic applications. Students' use of multimedia technology was least impact on ICT use on teaching and learning with agreement level of 157.

5.3 Discussion of findings

Results from the study carried out indicate that there are variations in infrastructure provision between schools in the district. There has been a remarkable effort by schools to acquire ICT infrastructure through the initiative of Computer for Schools Kenya, corporate organizations, and communities. Despite sustained government effort to facilitate ICT integration, minority of schools has poor access to ICT. 61.5% of schools where the study was carried had ten computers and above. But none of them use them as tool to support teaching and learning. This implies that introduction of technology in schools does not by itself means that they will be integrated in teaching and learning. Most schools treat ICT as discrete subject where emphasis is teaching basic skills for software use and information gathering. Many teachers are working in an environment that does not support ICT use. Other findings are discussed as follows.

5.3.1 ICT infrastructure and access

The researcher set out to establish the extent to which ICT infrastructure and access influences ICT adoption in educational environment. From the study 54.9% of teachers had personal access to ICT and use it, but they were reluctant to use it in their work. These findings lead to re-interpretation of previous results by BECTA (2004) which highlighted that access of computer at home was assumed to allow utilization of technologies in work place. Office software such as Word, Excel and PowerPoint were the only applications used to some extent. This correlates with findings by Totter et al (2006).

The findings indicate insufficiency of computer at schools particularly for teachers' use. This is in tandem with Bingimlas (2009) who stated that computer access has been a hindrance to technology adoption in teaching and learning. The participants agreed that the

number of computers and their quality affect their use in classroom. Apart from their availability, the ease of access which is mainly determined by the structural arrangement of ICT infrastructure is a key to their effective utilization. Having a computer in classroom is more likely to influence teachers' use of technology in their instruction than teachers who do not have. Computers in the classroom ensure that teachers and students can access them always.

The interview revealed lack of funds as a reason why teachers do not use technology in their classes. According to MOEST (2005) funds are necessary to purchase hardware and software, maintain computers, pay monthly internet fees, and cover the salary for technical support specialist. The situation is worsened by government failure to allocate budget to funds ICT programs in schools. Some schools have put in place programmes to expand their educational ICT infrastructure to reduce the students-to-computer ratio. In one school, the interview revealed that there is a plan to purchase five computers every year, and upgrade the current technologies.

Access to internet for most schools was available only through teacher personal initiatives. The findings concur with UN (2004) reports that noted lack of affordable access to network infrastructure as problem common to LCDs. This means that not all teachers and students use internet. The effort by teachers indicates increased internet popularity. Lack of fiber cables in rural areas has reduced connectivity widening the digital divide. But installation of undersea cables brings hope of widespread access to broadband connectivity. The Internet is a powerful repertoire of resources for staff professional development and students as echoed by UNESCO (2007). Lack of technology plan, growing poverty, and exponential rise in student population are great hindrance to acquisition of ICT infrastructure. One interviewee confessed that the ICT infrastructure are purchased only when need arise. Leadership plays a key role in ICT integration. Proactive

leaders can reach to various corporate organizations such as bank that happens to face out their ICT infrastructure. Despite their status, the infrastructure can act as good starting point for starters. Later schools can upgrade or purchase newer technologies to cope with current rapid technological changes.

5.3.2 ICT knowledge and skills

Teachers play a crucial role in adoption and implementation of ICT in education. Training on use of ICT was pointed out by many as crucial to use of computer in classroom. The quality of training on use of ICT in both in-service and pre-service is either inadequate or lacking. Jung (2005) stated that teachers should be modeled to fit in modern educational settings through their initial education and continuous professional development.

The participants who were interviewed acknowledged that they do not emphasize on computer use in their schools due to teachers' lack of skills. As noted by Gomes (2005), most teachers training program lack pedagogical and didactic formation of how to use ICT in classroom context. Those who make use of computers possess basic literacy skills. But it has been noted from past research that teachers' training programmes mainly focus on basic literacy skills (Afshari et al, 2009). Such competence cannot support full integration of ICT. Professional development policies should support ICT-related teaching models that encourage both students and teachers to play an active role in teaching activities. Interview revealed that teachers need to be equipped with ICT skills to operate productively in classrooms and undertake other administrative tasks efficiently. Wai-Kong (2009) reveals that, training teachers on ICT-related skills within the context of classroom objectives and activities ensures the development of skills in the integrated use of ICT in teaching.

The study found lack of in-service training on ICT use as key barrier to adoption of ICT in teaching and learning. Wai-Kong (2009) continues to note that, teachers should be exposed to structured opportunities for retraining, upgrading, and acquisition of new

knowledge and skills in-service, including workshops, courses, and postgraduate certificate and degree programs. Teachers should be given opportunities to regularly update their skills as well as change their views on changing curricula and pedagogical practices while they integrate technology in education. Afshari et al (2009) notes that for training to achieve its objectives it should be modeled to ensure effectiveness taking into consideration other factors such as time for training, pedagogical training, skills training and ICT use in initial teacher education. But the location of most schools denies teachers access to professional development opportunities that are mainly found in urban areas.

5.3.3 Technical support

Availability of technical support increases confidence and teachers' willingness in adoption of ICT. Yildirim et al (2009) in their studies found technical support, and expertise in using ICT as factors that influence ICT adoption in educational institutions. This is in line with research findings that revealed lack of technician or media specialist due high cost of engaging them a common problem to all schools involved in the study. Observation revealed accumulation of broken computers that has not been serviced for several months. Locations of most schools coupled with poor infrastructure such as roads discourages those with ICT technical knowhow to offer services as most technicians are based in urban areas an observation similar to that of Birungi and Musoke (2004).

The interviewees expressed their inadequacy in training staff on computer maintenance due to lack of funds and training opportunities. Training teachers on computer maintenance would ensure that extremely rapid responses are made to breakdowns. Rapid response system should be put in place to deal with range of technical problems such as; mal-function computers, failing to connect to internet, faulty printers, and use of old computers which support the views by Invers (2003). This can guard against unnecessary

delay on technologies maintenance by providing preventative technical support. Teachers need an assurance of help when things go wrong while using computers.

5.3.4 Teachers' time

The biggest barrier to the adoption of computers identified by participants in the survey was lack of time available in classes, and in their own schedule for planning similar to findings by Hennessy, Harrison, and Wamakote (2010). Teachers revealed that availability of release time is important when it comes to computer use in class. The research found out that teachers have many as seven lessons in a day. Yildirim et al (2009) considers lack of time as an extrinsic barrier that makes teacher stay away from ICT, and they cannot fulfill their personal development in this field. Teachers require time to prepare and experiment with digital materials for use in class. They also agreed that, there was not enough time for students to use computers. This is in line with Gulbahar (2008) who noted that class time is too limited for ICT usage in education institutions in Turkey. Principals that were interviewed noted that lack of enough teaching staff has led teachers to manage huge teaching loads. This reduces much needed time by teacher to prepare and experiment with ICT. But ICT has potential to address workload and productivity issues, but institutions and teachers need a better understanding of how technology applications can realize efficiencies (Hennessy et al, 2010).

Time and opportunities to interact and share experience of using new technologies with peers was also noted as factor that influences ICT adoption. But due to high course load teachers tend to use the traditional methods of teaching that do not require much preparation. Gulbahar (2008) suggest that the policy maker should provide additional planning for teachers to experiment with new ICT based approaches by reducing the teaching workload.

Interview revealed schools were reluctant to integrate ICT in educational environment because students complained of lack of opportunity to use computers whenever they needed and requested for more time which concurs with findings by Demiraslan and Usluel (2008).

5.3.5 ICT integration in teaching and learning

From research both teachers and principals were in agreement that ICT if well utilized can tremendously enhance teaching and learning which is in line with Afshari et al (2009) who note that use of ICT create a powerful learning environment where students deal with knowledge in active, self directed and constructive manner. As a tool, ICT can enrich educational environment by providing both teachers and learners with multiple source of information that can lead to improved quality of teaching and learning.

The researcher found out that, integration of ICT lead increased use of generic applications such PowerPoint, multimedia software for simulation, and publishing and presentation tools that leads improved presentation as noted by MOEST (2005). The applications must take into account the need for local content for them to be relevant. Most of ICT policies that has been put in place lay more emphasis on IT infrastructure in educational institutions disregarding the need for developing local contents to be delivered by the technology. The generic applications should be developed to meet the needs of learners and teachers. Adoption of foreign software should be done upon verification that they can deliver the needs of the school.

ICT provide variety of resources like lesson plans from internet. Internet can facilitate teachers and student to link up with education institutions world wide. Schools can share resource through establishment of Local Area Networks (LANs). This can aid collaborative work and communication among teachers and students from different schools. This converges with views by Birungi and Musoke (2004) who notes that teachers

and learners can benefit from educational resources and receive instructions online. Technology supports student use of multimedia technology that support student centered learning approach which was manifested in some schools that have installed Encarta Encyclopedia.

Results from the study showed that participants were in agreement that professional development through internet can equip teachers with current trends on instructional delivery leading to improved productivity. Gaible, Edmonds and Burns (2005) argues that computers and the Internet can benefit all parts of the education system, including student learning, teacher development, school leadership, and management. Teachers may gain benefits from using these tools in the areas of content, curriculum, instruction, and assessment. Computers are best used to help teachers build intermediate and advanced skills.

5.4 Conclusions

ICT integration is a complex process which is influenced by a number of factors. Teachers have a strong desire to adopt ICT in educational environment. But from the findings which are supported by literature, teachers' encounters variety of challenges. These include availability of ICT infrastructure and their access. Availability of resources results in fulfillment of teachers and students expectations regarding interactive classroom environment.

The level ICT knowledge and skills greatly influence the decisions and choices teachers' make regarding ICT. They should be provided with learning opportunities on how to use new technologies. Training offered to teachers should contribute to teaching process by explaining to teachers which pedagogies they should adopt and the types of strategies they should develop to minimize possible problems that might arise in the process of

integration. Training in use of new technologies in classroom helps to increase the teacher's efficiency in using ICT in education effectively.

ICT in teaching and learning needs technician who can assist teachers through offering maintenance skills to teachers and fix problems when they arise. Services provided by technicians have proved to be fairly costly hence schools have resulted to various ways to meet their needs for computer maintenance. Schools repair their computers once per year or incase of computer malfunctions or breakdown.

Teacher's time is crucial if teachers are to use ICT in classrooms. Provision of adequate time increases the possibility of technology use in class. Schools may have ICT resources but availability of time will influence their access by teachers and students. Time is important to develop a vision on how to integrate technology in classroom and time in classroom to use technology Totter et al (2006). Therefore, government should come up with policies that assist creation of time in teachers' schedule explicitly allocated to development of digital materials for classroom use.

Resistance by both teachers and principals to accept the reality that the current world requires ICT compliant citizen is a huge barrier to ICT adoption. Teachers' should be brought on board during ICT policy formulation and implementation. The teachers' thinking process should be challenged. They should be convinced that the new pedagogical approaches are better than the traditional practices.

5.5 Recommendations

The study recommends sensitization of teachers and school management about the benefits of ICT. This would assist in changing the beliefs held by many teachers that teaching through ICT is a waste of time.

Government should allocate funds to cater for ICT programs in schools. This would lead to equity in terms of ICT infrastructure and access in schools. The government should put in place policies that facilitate sharing of ICT infrastructure (fiber cables) among schools especially in rural areas to reduce the cost of connectivity.

Ministry of Education should initiate a continuous in-service training on ICT for all teachers. Training helps in overcoming resistance to change toward technologies adoption. It increases confidence.

Review of present curriculum that over burden both teachers and students therefore denying them time necessary to familiarize and learn how to use technologies in teaching and learning.

5.6 Suggestions for further studies

The study suggests more research be done on resistance to change among teachers concerning the use of new technologies and methodologies.

With a wide spread belief that school culture is an important consideration in terms of ICT integration, more research need to be done to establish how schools culture influence ICT adoption in teaching and learning.

5.7 Summary

The findings indicate that, despite the government initiative to facilitate ICT introduction in schools, there is variation in ICT integration between schools. Significant number of school has poor access to ICT. Highlighted in the chapter includes; conclusions, recommendations and suggestions for further research.

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APPENDICES

Appendix 1

LETTER OF INTRODUCTION

ELIJAH KAHANDO KARIMI

P.O. BOX 314 – 10204

KIRIA – INI

Tel. No. 0721331037

Dear Sir/Madam,

Greetings. I am a masters student from University of Nairobi currently undertaking research on factors influencing integration of ICT in teaching and learning in secondary schools in Mathioya district. The information you will provide will be treated with a lot of confidentiality and will be used strictly for academic purpose. Please try and give objective and honest answers to the question.

Thanks.

Yours faithfully

Elijah K. Karimi

Appendix 2

QUESTIONNAIRE

INTRODUCTION

The researcher is carrying out a research on factors influencing integration of ICT in teaching and learning in secondary schools in Mathioya District.

Instructions: Please answer the questions objectively and truthfully as possible. Do not write your name anywhere on your questionnaire. Provide information as accurately as possible for it to be useful in this study. Use a tick (√) to indicate your response where appropriate.

A) BACKGROUND INFORMATION

Gender   Male ☐   Female ☐

i)   Year of experience as teacher

Less than 5 years   ☐

6– 10   years   ☐

11 – 15 years   ☐

More than 15 years   ☐

ii) School category:

National   ☐

Provincial   ☐

District   ☐

iii) Do you have a computer at home?   Yes ☐   No ☐

iv) Does your school have computers?   Yes ☐   No ☐

v) If yes how many? _____

vi) Where are the computers placed?

Computer lab   ☐

Classrooms ☐

Staffroom ☐

Other (specify) _____

vii) How often do you make use of computer laboratory?

Daily ☐

Weekly ☐

Monthly ☐

Less than once per month ☐

Never ☐

viii) What types of program do you use in the school?

Word processing ☐

PowerPoint ☐

Publisher ☐

Excel ☐

Databases ☐

Other (specify) _____

ix) How often do you access computer?

Always ☐

Often ☐

Rarely ☐

x) What types of task do you undertake using computer.

a. Classroom presentations (PowerPoint/CDs/DVDs) ☐

b. Create instructional material, preparation of assignments and tests ☐

c. Administrative record keeping (Student Grades, Students details class

attendance etc.) ☐

d. Play computer games ☐

e. Type letters and other documents ☐

f. Other (specify) _____

xi) Is the computer you use connected to the internet? Yes ☐   No ☐

xii) If you use the Internet, please indicate the type of use:

a) Communicate with family/friends ☐

b) Communicate with other teachers or students on School related matters ☐

c) Search for information on topics of personal interest (e.g. Hobbies, etc.) ☐

d) Search for information and content for lessons ☐

e) Retrieve research & best practices for teaching/learning ☐

f) Retrieve Model Lesson Plans ☐

g) Other (Please state) _____

xiii) What is your average number of lesson per day? _____

xiv) What is your average number of free lesson per day? _____

B) ICT INTEGRATION IN TEACHING AND LEARNING

Indicate the extent to which you agree with the following on ICT integration in teaching and learning.

Impact	Strongly agree	Agree	Uncertain	Disagree	Strongly disagree
There is increased staff use of generic applications (Ms word, Excel, database, etc)					
Increased resources (instructional materials from internet)					
Improved presentation of work					
Students use of multimedia technology (CD, DVDs,					
Provision of professional support through internet (Online learning)					
Improve productivity					

C) INFRASTRUCTURE AND ACCESS

Indicate the extent the following factors influence use of ICT in teaching and learning.

Factors	Strongly agree	Agree	Uncertain	Disagree	Strongly disagree
Number of computers.					
Internet connectivity					
Access to computer.					
Power supply.					
Cost of hardware and software.					
Availability of appropriate software.					
Structural arrangement of ICT infrastructure.					
State and quality of computers.					

D) ICT KNOWLEDGE AND SKILLS

Indicate the extent the following factors influence use of ICT in teaching and learning.

Factors	Strongly agree	Agree	Uncertain	Disagree	Strongly disagree
Finance to train staff on use of ICT programs					
Amount of pre-service training on use of ICT.					
Amount of in-service training on use of ICT.					
Familiarity with good practice rooted on understanding of how					
Students training on how to use computers.					

E) TECHNICAL SUPPORT

Indicate the extent to which you agree that the following factors influence integration of ICT in teaching and learning.

Factors	Strongly agree	Agree	Uncertain	Disagree	Strongly disagree
Availability of technician or media specialist to help teachers with computer hardware or software					
Cost of computer maintenance and upgrading.					
Cost of engaging computer expert staff.					
Staff training on computer maintenance.					
Computer and technology break down during teaching process.					
Rate of computer and other digital equipment.					

F) TEACHERS' TIME

Indicate the extent to which you agree that the following reasons influence the adoption of ICT in school.

Reasons	Strongly agree	Agree	Uncertain	Disagree	Strongly disagree
Time to research and prepare digital material for use in class.					
Scheduled time for teachers to practice using computers with student					
Time and opportunities to interact and share experience of using new technologies with peers.					
Time for training and exchange ideas with experts on how to use new technologies.					

THANK YOU

Appendix 3

INTERVIEW GUIDE FOR SCHOOL PRINCIPALS

1. Gender

   Male ☐   Female ☐

2. Year of experience as principal

   a) 1-5   ☐

   b) 6-10   ☐

   c) 11-15   ☐

   d) 15 and above ☐

3. Does your school have a culture of technology use i.e. in teaching and learning?

   ....

   ....

4. How many computers does your school have and how did it acquire them?

   ....

   ....

5. Is your school connected to the internet and what is it main use?

   ....

   ....

6. What is your school yearly budget on ICT?

   ....

7. Does the government grant an extra budget for the ICT education at your school?

   ( ) Yes   ( ) No

8. If yes, what is the budget allocated for?

   ( ) Classroom infrastructure including the purchase of hardware and software

   ( ) Supplement for running/working expenses

( ) Human resources including hiring and training teachers

Others...

....

9. Does your school have a technology plan?

....

....

10. What tasks are undertaken by use of computers by both teaching and supporting

staff..

....

11. Does your school have a teacher(s) who specializes in ICT education?

....

12. Are the teachers given opportunities to learn to integrate computers into their

classroom

practices..

....

13. Has your school introduced Computer Assisted Instruction (CAI)?

( ) Yes ( ) No

14. If yes, how do you get the software?

( ) Purchased market product   ( ) Created by a teacher

Others ( ) ....

15. Which grades of students use computers in the classroom?

....

16. Do you believe that your teachers are motivated adequately to use ICT in teaching

and learning in terms of:

a) training...

b) administrative support ....

17. How do the following affect adoption of ICT in your school?

(a) Community support...

(b) Infrastructure i.e. electricity, hardware and software.

....

(c) Teaching and supporting staff level of skills in ICT.

....

(d) Student level of skills in ICT.

....

(e) Cost of hardware and software, Maintenance, upgrading updating.

....

(f) School population: Does it affect access to ICT infrastructure.

....

(g) Insecurity..

(h) Support from teaching staff during implementation of key decisions.

....

(i) Lack of qualified technician or media

specialist..

....

18. Do you think teaching load for teacher influence use of technologies in teaching

and learning?

....

Appendix 4

LIST OF SCHOOL IN MATHIOYA DISTRICT

1. GATUNGURU SECONDARY SCHOOL
2. GIKOE SECONDARY SCHOOL
3. GITONGU SECONDARY SCHOOL
4. GITUGI GIRLS SECONDARY SCHOOL
5. GITUGI MIXED SECONDARY SCHOOL
6. IRURI SECONDARY SCHOOL
7. J.M. KAIRO SEOCNDARY SCHOOL
8. KAMACHARIA SECONDARY SCHOOL
9. KAMBARA SECONDARY SCHOOL
10. KAMUNE SECONDARY SCHOOL
11. KARUNGE SECONDARY SCHOOL
12. KIAMBUTHIA SECONDARY SCHOOL
13. KIAMUTURI SECONDARY SCHOOL
14. KIHURO SECONDARY SCHOOL
15. KIRIA-INI GIRLS SECONDARY SCHOOL
16. KIRIA-INI MIXED SECONDARY SCHOOL
17. KIRIKO SECONDARY SCHOOL
18. KIRITI GIRLS SEOCNDARY SCHOOL
19. KIRU SECONDARY SCHOOL
20. MANANGA SECONDARY SCHOOL
21. MATHIOYA SECONDARY SCHOOL
22. MATUTO SECONDARY SCHOOL
23. MIHUTI SECONDARY SCHOOL
24. MIORO SECONDARY SCHOOL
25. NGAAMBA SECONDARY SCHOOL
26. NJUMBI HIGH SCHOOL
27. RUNYEKI SEOCNDARY SCHOOL
28. THUITA SECONDARY SCHOOL
29. WAHUNDURA SECONDARY SCHOOL

SOURCE: DISTRICT EDUCATION OFFICE (D.E.O) - MATHIOYA