

**ADOPTION OF INFORMATION, COMMUNICATION AND TECHNOLOGY
AMONG SECONDARY SCHOOL TEACHERS
IN BARINGO NORTH DISTRICT,
KENYA**

**BY
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STUDIES, MOI UNIVERSITY**

OCTOBER, 2013

DECLARATION

Declaration by the Student

This thesis is my original work and has not been presented in part or as a whole for any academic award in any university.

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DEDICATION

This research thesis is dedicated to my loving wife Sarah and my children; Abijah and Ephraim, for their unwavering support during the research period.

ACKNOWLEDGEMENTS

I acknowledge and thank God, the Almighty, for enabling me to accomplish this noble and worthy task. To my supervisors; Prof. J. K. Too and Dr. Kerei, for their professional guidance and commitment throughout my research period. To all my lecturers from the department of Educational Management and Policy Studies who assisted me during coursework and proposal development. To my colleagues for their moral support during the learning sessions. To the principals and teachers of both the pilot and main study schools for allowing me to collect data in their schools. To all who contributed to the success of my studies, I say God bless you abundantly. To God, who is the source of wisdom, knowledge and understanding; to Him be honour and might for ever.

ABSTRACT

The purpose of this study was to investigate the adoption of ICT among secondary school teachers. The study sought to establish the relationship between teacher characteristics and the adoption of ICT; attitude towards adoption of ICT and the influence of principal's ICT leadership on the adoption of ICT among secondary school teachers in Baringo North District. This study was based on Technology Acceptance Model theory by Davis. Relevant literature on adoption of ICT was reviewed under the following subheadings; Global outlook, African context and the Kenyan perspective. A descriptive survey research design was used with a total of 102 respondents participating in the study. A sample of eight public secondary schools which had introduced computers were selected using simple random sampling method. A structured questionnaire that uses likert type scale was used to collect data from the teachers while an interview schedule was used to collect data from the principals. Piloting of the questionnaire was carried out in the adjacent Baringo Central District. Results of the analysis of data from the pilot study found the instrument to be reliable. Data collected during the main study was analyzed using Statistical Package for Social Sciences (SPSS). Frequency tables, percentages and means were the main descriptive statistics used while Chi-square and regression analyses were the inferential statistics used to test the hypotheses of the study. The main findings of the study indicated that teachers had not fully adopted ICT in teaching and learning despite showing positive attitudes towards adoption of ICT. Of the teacher characteristics tested, only age had a statistical significance. Accordingly the study recommends that policy makers and curriculum developers should consider making ICT a core subject in secondary schools. It is recommended that teachers be in-serviced on the use of ICT in teaching and learning with emphasize on the older staff. Further, secondary school principals should provide prudent leadership in ICT implementation.

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LIST OF ABBREVIATIONS

GOK	—	Government of Kenya
ICT	—	Information Communication Technology
ITU	—	International Telecommunication Union
KIE	—	Kenya Institute of Education
MOE	—	Ministry of Education
MOES&T	—	Ministry of Education, Science and Technology
PEOU	—	Perceived Ease of Use
PU	—	Perceived Usefulness
TAM	—	Technology Acceptance Model

CHAPTER ONE

INTRODUCTION TO THE STUDY

1.0 Introduction

This chapter comprises background of the study, statement of the problem, purpose of the study, objectives, research hypotheses, assumptions, significance, scope, limitations, theoretical framework and operational definition of terms.

1.1 Background of the Study

The society is moving very fast into a digital world characterized by ICT in various forms such as desktop computers, laptops, LCD projectors, e-resources, softwares, peripheral devices, storage devices and communication devices among others. All sections of society and entire human life is being defined and controlled by ICT forces. Education has not escaped with teaching as well as learning processes coming under scrutiny as pertaining instructional technology. Technological changes are urgently needed for the education sector to adapt to this new platform. Literacy, technology and instruction have always had an interconnected history in which changes in technology influenced occurrences in the literacy classroom (Krachmer, 2001). Digital technologies should be integrated into the literacy curriculum to facilitate acquisition of new literacies competencies (International Reading Association, 2009).

The adoption of ICT in teaching and learning is an innovation that has revolutionized the education system (Khalid, Nawawi & Roslan, 2009). There is a widespread believe that ICTs can and will empower teachers and learners, transforming teaching and learning processes from being highly teacher-dominated to student-centered (Trucano, 2005).

Trucano argues that this transformation will result in increased learning gains for students, creating and allowing for opportunities for learners to develop their creativity, problem – solving abilities, informational reasoning skills, communication skills, and other high-order thinking skills.

Research reveals that the use of technology in the classroom is beneficial to students and teachers (Mwangi, 2011; Wanami, 2010). Not only does it prepare students for the ‘real world’ by stimulating real environments; it also improves skills that might not otherwise be fully cultivated in a traditional learning setting. Mwangi (2011) observes that ICT tools have helped to improve autonomy in learning, stimulate students’ sensory and cognitive curiosity, develop life skills, boost self-confidence and facilitate the learning of abstract ideas and theories. Aduwa and Iyamu (2005) reported that when properly used in the field of education, ICT hold great promise to improve teaching and learning in addition to shaping workforce opportunities.

Computer use in the US has penetrated every sphere of their citizens’ lives (Momanyi, Norby & Strand, 2006). The study notes that Americans went ahead and integrated computer use in their homes, schools, industry and the service sector. That almost all the schools across the US are equipped with new instructional technologies. In 2003, International Telecommunications Union (ITU) conducted a study which showed that over half of the households in USA own computers compared to less than 1% in Africa (ITU, 2003). ITU noted that about 77 million computers in USA have valid internet addresses while a country like Chad has fewer than ten computers linked to the internet. ICT in education is seen as a way of widening access to education particularly in developing countries (William, Sieborger & Terzoli, 2007).

The constraints of ICT development in Africa include lack of infrastructure, absence of ICT policy or its implementation, few trained or skilled personnel, poor knowledge of ICT and financial constraints (Adeya, 2001).

Menjo (2007) contends that computers were first introduced in Kenyan secondary schools around 1980s, when the MOE approved a pilot project on the use of computers in schools starting with the Aga Khan academy. The primary aim of introducing the computers to schools was to make students computer literate. To achieve the objective, teachers were trained in the use of computers under the Computers Education Project of the Aga Khan Education Service (CEPAK) to be able to impart the necessary computer skills to students. Menjo affirms that starting late 1980s, increasing number of schools in Kenya began on their own to acquire computers for use in the institutions.

Momanyi (2011) asserts that ICT is the uncontested engine of Kenya's economic growth. The sector has turned the country into an increasingly interconnected network of individuals, firms, schools and government; communicating and interacting with each other through a variety of channels and providing economic opportunities transcending geographical borders, languages and cultures. Momanyi argues that though technology is revolutionizing communication; it is only slowly penetrating the school curriculum in Kenya. Ratemo (2011) notes that Kenya is on the path to establishing digital learning in schools to boost quality and access to education. He explains that KIE has produced digital content in a format accessible by ICT devices such as television, radio, computers and mobile phones. The onus is on teachers and other stakeholders to embrace the new platform of making e-learning a reality in Kenyan secondary schools.

Wanami (2010) studied factors influencing the integration of computer skills in secondary schools curriculum in Uasin Gishu District in Kenya. He found out that the majority of the schools have not integrated computers for their curriculum. The reasons for this impasse range from an already overcrowded school offering, to lack of resources. This leads to a state of business as usual in these schools as they maintain the status quo of using traditional methods of teaching which are devoid of instructional technology. The factors that are often cited as having an influence on ICT use are gender, age, income, level of education and the availability of infrastructure in an area (Madhusudan, 2002; World Bank, 1998). Teacher attitudes towards computers (Clark, 2001) and school principal's ICT leadership (Tondeur, Herman, Van Braak & Valcke, 2008) influence adoption of ICT in secondary schools.

A number of secondary schools in Baringo North district have acquired computers using their own financial resources while others got them through donations yet they remain underutilized in curriculum and administrative purposes. It is against this background that the researcher investigated the adoption of ICT among secondary school teachers in Kenya and Baringo North District in particular. This study surveyed the influence of teacher characteristics (gender, age, subject area and academic qualification), attitudes and principals' ICT leadership on the adoption of ICT among secondary school teachers in Baringo North District.

1.2 Statement of the Problem

Modern Information, Communication and Technology (ICT) advances have permeated the education sector that seems to respond slowly at secondary school level. The uses of

ICT in schools have been emphasized by many studies (Getau, 2004; Fox, 2005; Mean & Oslon, 1995; Sifuna, Chege, & Oanda, 2006). Preparedness of teachers in using the new technology is a challenge (Barasa, 2005; GoK, 2007). Kerre (2010) pointed that in education, ICT is a core subject of modern times because of its wide spectrum of applications. Trucano (2005) noted that while impact on student achievement is still a matter of reasonable debate, a consensus seems to have formed that the introduction and use of ICTs in education can help promote and enable education reform, and that ICT is a useful tool to motivate learning and promote greater efficiencies in education systems and practices.

Despite all these benefits of ICT, many schools in Kenya lag behind. Teachers are still only comfortable with the traditional way of teaching. Many are yet to apply ICT for lesson preparation and delivery (Mwangi, 2011; Wanami, 2010). Although a number of schools in Baringo North District have computers, they are not being utilized in all administrative duties and across the curriculum. Majority of the schools are yet to exploit current ICT potentials. The critical questions at the moment are whether secondary school teachers in Baringo North District possess the right attitudes towards the adoption of ICT. Secondly, to what level have they adopted ICT in teaching and learning?. Thirdly, do school principals support adoption of ICT among secondary school teachers?. There is need therefore to investigate the adoption of ICT among secondary school teachers particularly in Baringo North District. This study proceeded to fill this gap.

1.3 Purpose of the Study

The purpose of this study was to investigate the adoption of ICT among secondary school teachers in Baringo North District.

1.4 Research Objectives

The objectives of the study were;

- i. To establish whether there is any significant relationship between teacher characteristics (gender, age, subject area and academic qualification) and the adoption of ICT among secondary school teachers in Baringo North District.
- ii. To investigate the attitudes of secondary school teachers towards adoption of ICT in secondary schools in Baringo North District.
- iii. To determine the influence of Principal's ICT leadership on the adoption of ICT among secondary school teachers in Baringo North District.

1.5 Research Hypothesis

The study was guided by the following research hypotheses;

H₀₁: There is no significant relationship between gender and the adoption of ICT among secondary school teachers.

H₀₂: There is no significant relationship between age and adoption of ICT among secondary school teachers.

H₀₃: There is no significant relationship between subject area and adoption of ICT among secondary school teachers.

H0₄: There is no significant relationship between academic qualification and adoption of ICT among secondary school teachers.

H0₅: There is no significant difference between independent variables (gender, age, subject area and academic qualification) and adoption of ICT among secondary school teachers.

1.6 Assumptions of the Study

A number of assumptions were made. The study was confined to public secondary schools whose students have sat KCSE examination and therefore assumed to have developed physical facilities and instructional materials for teaching and learning. It was assumed that schools were implementing the national ICT policy on e-learning; that the respondents would express their sincere feeling in responses to the questionnaire items and that the attitudes of secondary school teachers towards adoption of ICT would be expressed when solicited.

1.7 Significance of the Study

This study was embedded in the passion to discover the level of adoption of ICT among secondary school teachers. Adoption of ICT is important in improving the quality of teaching and learning by making it learner-centred. The findings of this study help schools in formulating or improving their school ICT policy. The study findings are also of particular interest to policy makers, especially the MOE and KIE, in developing strategies that catapult the adoption of ICT in secondary schools in Kenya. In matters of sponsorship, the study may attract donors to aid ICT penetration in schools. It also adds up to the body of knowledge in the area of e-learning by contributing literature on

adoption of ICT in secondary schools.

1.8 Scope and Limitations of the Study

1.8.1 Scope of the study

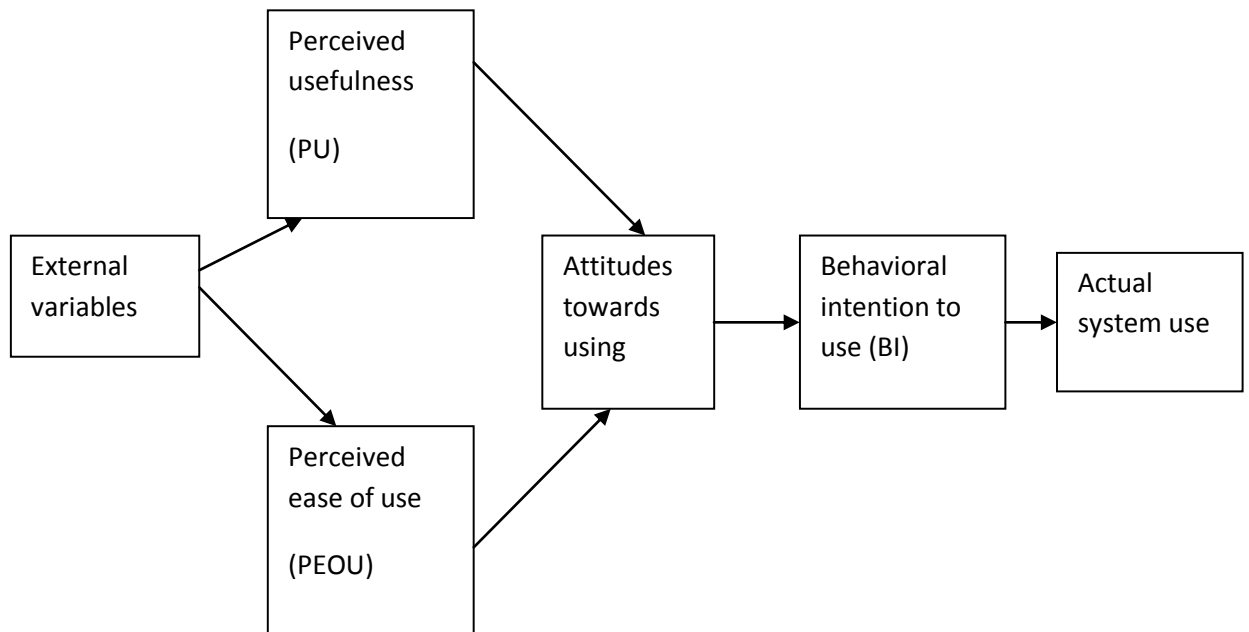
This study was primarily concerned with the adoption of ICT among secondary school teachers in Baringo North District. The District had 20 public secondary schools of which 15 had introduced computers. The study was confined to 11 public secondary schools with computers that had been in use for at least one year. The study was conducted in eight schools selected using simple random sampling. Both qualitative and quantitative data was collected from the representative sample. Principals and teachers formed the respondents of the study.

1.8.2 Limitations of the study

The emphasis on adoption of ICT was limited to computer use in secondary school set up. Respondents were quite busy in their schools but the researcher reduced this by booking appointments. Inaccessibility of some secondary schools was a challenge on honoring of appointments but the researcher made up for the appointments and persisted until all data was collected. Proficiency issues are always sensitive as no one likes to admit a certain training limitation and as a result cooperation from respondents did not come easily. Nevertheless, the researcher assured them of privacy and confidentiality anchored in the study.

1.9 Theoretical Framework

The theoretical framework for this study was grounded in the Technology Acceptance Model (TAM) advanced by Davis (1989). TAM is an information systems theory that models how users come to accept and use a technology. The model suggests that when users are presented with a new technology, a number of factors influence their decision about how and when they will use it, notably; Perceived usefulness (PU) and Perceived ease-of-use (PEOU). Figure 1.1 shows the TAM model.



Source: Davis, 1989

Figure 1.1: Technology Acceptance Model

PU is the degree to which a person believes that using a particular system would enhance his or her job performance. It will be influenced by perceived ease of use, because, other things held constant, the easier is a technology to use, the more useful it can be. On the other hand, PEOU refers to the degree to which a person believes that using a particular

system would be free from effort. By assuming that other variables are constant, in PEOU, the easier is a technology to be used; the higher is its possibility to be adopted by users. It is the users' perception of the amount of effort needed to use the system. It is measured in terms of how clear and understandable the interaction with the system, and ease of use of the system (Davis, 1989). TAM is an adaptation of the Theory of Reasoned Action (TRA). It posits that perceived usefulness and perceived ease of use determine an individual's intention to use a system with the intention to use serving as a mediator of actual system use.

The TAM model was chosen because it addresses the variables of the current study which includes teacher characteristics, attitudes towards adoption of ICT and principal's ICT leadership. The TAM has received extensive empirical support in research (Legris, Inghamb & Colletterec, 2003; Mathieson, 1991; Plauffe, Hulland & Vandenbosh, 2001). Studies show that external variables such as characteristics of system design, training, documentation and characteristics of decision-maker may also influence technology usage (Davis, Bagozzi & Warshaw, 1989). This external variable may manifest in different experiences among men and women as noted by Legris et al. (2003). Some studies have included the gender variable into the TAM (Gefen & Straub, 1997; Venkatesh & Morris, 2000). Therefore TAM guided this study which explored the relationship between teachers' gender, age, subject area and academic qualification, and adoption of ICT among secondary school teachers.

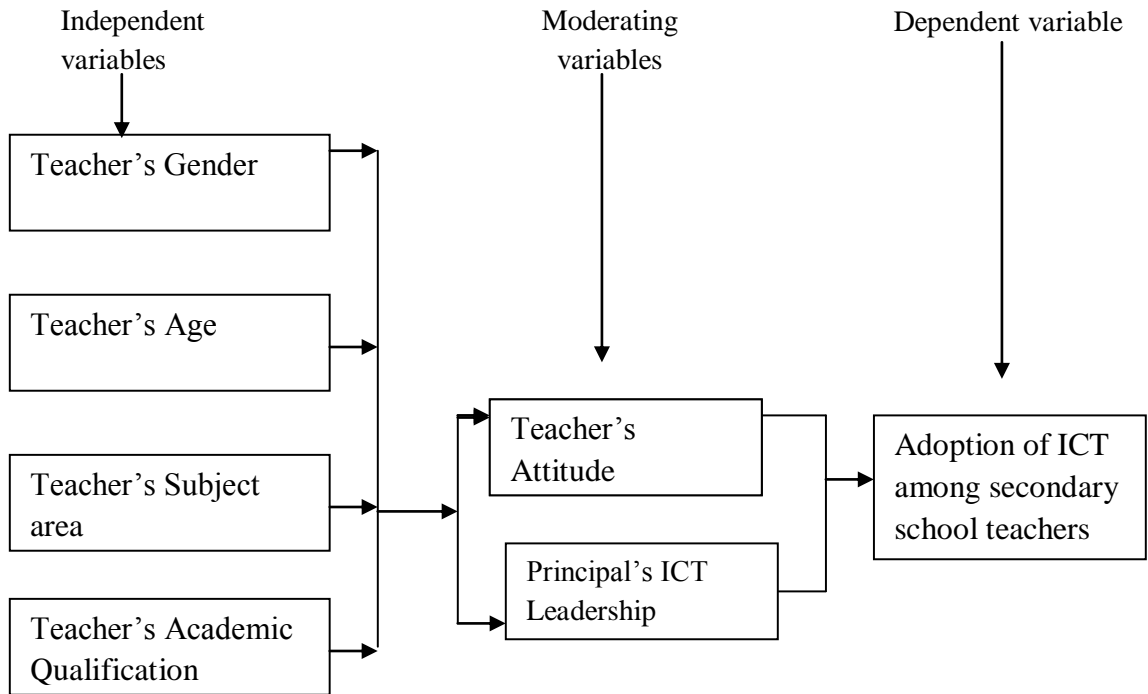
TAM specifies the casual relationships between systems design features, perceived usefulness, perceived ease of use, attitude towards using, and actual usage behavior. Perceptions influence attitudes; these attitudes then affect behavioral intention to use a technological system; such intentions influence actual technology use (Polizzi, 2011). He (Polizzi) reinforces that adopters' perceptions and attitudes are some of the most important variables for explaining any innovation-decision process. Attitudes towards computers influence teachers' acceptance of the usefulness of technology, and also influence whether teachers integrate ICT into their classroom (Clark, 2001; Huang & Liaw, 2005). Technology implementation plans for schools require their adopters to hold favorable attitudes towards their introduction (Polizzi, 2011). Therefore TAM has guided the study on the influence of teachers' attitudes on the adoption of ICT among secondary school teachers.

Secondary schools require permanent ICT change (actual system usage), a position where technology is adopted for administrative duties as well as in teaching and learning. Fullan (1991) contends that the management of change and innovation has shown that the process of change is a complex one, involving not only changes in infrastructure and curriculum materials, but more importantly of practices and beliefs. The most effective way to bring about the adaptation of an innovation in schools is to engage the whole school in a democratic process of planning change. Senge (2000) notes that institutions should encourage its members to develop a sense of mastery with respect to the anticipated changes. Understanding the change process and providing long-term training, monitoring and financial support needs to occur within all levels of the education system (Fullan, 2002).

Overall, TAM was chosen by the researcher because it provides an informative representation of the mechanisms by which design choices influence user acceptance, and should therefore be helpful for forecasting and evaluating teacher acceptance of ICT at the secondary school level. Teachers are influential adopters of ICT at school level since through their attitudes and behaviors; they are able to introduce innovations both into their way of teaching and into their students' way of learning (Polizzi, 2011). Computers and computer technology are now an established part of education, the school curriculum and office management (Bakhada, 2006). The TAM theory therefore guided this study in terms of the approach taken in conducting literature review and formulation of the research instruments. The six components of the model were useful in providing a logical and systematic framework that underpinned the study.

1.10 Conceptual Framework

A conceptual framework is a translation of research variables and the relationship between them into a visual picture to illustrate the interconnections between the independent, extraneous and dependent variables (Oso & Onen, 2008). The conceptual framework for this study views teacher characteristics as the independent variables. Teacher attitudes and principal's ICT leadership form the moderating variables linking independent variables to the dependent variable of the study. Adoption of ICT among secondary school teachers is the dependent variable. The framework attempts to show how these variables interrelate in the attainment of adoption of ICT among secondary school teachers as shown in figure 1.2 below.

Figure 1.2: Conceptual Framework

Source: Researcher, 2012

1.11 Operational Definitions

Adoption: The acceptance of ICT in secondary schools and its subsequent utilization, infiltration and influence.

E-learning: Use of computers in teaching and learning with heavy use of internet in communicating as well as accessing current and relevant information.

ICT Leadership: The ability of a secondary school principal to champion for ICT resources at secondary school level. It includes effective resource mobilization through strategy and leadership skills.

Information Communication Technology (ICT): The use of computer as a tool for instruction and learning as well as running other vital programs in schools. It includes technologies that are used for accessing, manipulating and presenting information in secondary schools.

Instructional Technology: The purposeful application of information in the design, production, and adoption of computer services in the organization of educational activities.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter discusses the literature that has been reviewed for this study. The main aspects of the critical review include adoption of ICT in education as mirrored by global outlook as well as the African context. The Kenyan perspective is reviewed with special focus on MOE's policy on ICT, adoption of ICT in secondary schools, teacher characteristics, the attitudes of teachers towards adoption of ICT and the influence of Principal's ICT leadership on adoption of ICT among secondary school teachers. The chapter concludes by giving a summary of the reviewed work.

2.1 Adoption of ICT in Education: A global outlook

Across the globe, ICTs are becoming crucial platforms for teaching and learning. Opie and Katsu (2000) noted that the British government policy on the use of computers in schools was to ensure that each school had computers. Teachers were trained on their use and pupils were given opportunities to apply their skills and develop their ICT capability through their use of ICT tools to supplement their learning in all subjects. Higgins (2003), reports that UK has invested heavily in ICT for use by teachers and pupils in schools. Some of this investment has been directed by the government through initiatives such as the National Grid for learning and the New Opportunities Fund ICT Training for serving teachers. Substantial sums have also been spent by Local Education Authorities, Education Action Zones and schools themselves on ICT equipment and resources.

Higgins perceives that the ultimate goal in promoting the use of ICT in schools has been to increase the effectiveness of teaching and improve pupils' learning.

Zhao and Czite (2001) reports of American government's computer policy that included the provision of computers in schools to the ratio of one computer to ten students, and teachers were required to be trained and to be computer literate by taking computer courses. Boykin (2011) note that the vast majority of students who attend US schools have access to digital technologies, including computers and internet access, regardless of racial or socio-economic background. Momanyi et al. (2006) add that Americans went ahead and integrated computer use in their homes, schools, industry and the service sector; that almost all the schools across the US are equipped with new instructional technologies.

Malaysian government policy was formulated to develop ICT so as to convert all schools to smart schools by the year 2010 (UNESCO, 2012). The implementation plan comprised of integrated education with emphasize on thinking, language and value across the curriculum. In the Malaysian context, although extensive efforts were made under its computerizing programme to bring ICT to the secondary school classrooms, there exists a gap among schools in the use of ICT (Khalid et al., 2009). In exploring the extent of ICT adoption among secondary school teachers in Malaysia, Lau and Sim (2008) made a number of observations; use of ICT for teaching and instructional support was reported at 75% and classroom management at 49%, with least use for communication with peers at 26%.

A review of literature on adoption ICT of in education focusing on a global outlook has revealed that secondary schools in developed countries are ahead in the adoption of ICT. Teachers in these countries boast of state-of-the art technologies that makes them ICT competent in teaching and learning. Emerging economies such as Malaysia are now ICT powerhouses since their schools are equipped with ICTs while their teachers have been trained on the use of ICT. This scenario is in contrast to the Kenyan situation and Baringo North District in particular which lags behind in ICT implementation. Majority of the secondary schools have inadequate number of computers with some schools having none at all. The schools which have computers underutilize them in administrative duties and across the curriculum. This study sought to establish the adoption of ICT among secondary school teachers in Baringo North District.

2.2 Adoption of ICT in education: The African context

Aduwa and Iyamu (2005) argued that to be a major player in the global market place and prepare her citizens for the new environment of today and the future, Nigeria should embrace ICT to aid in teaching and learning, as a tool for management, as an instrument for economic development, and as instrument of high technological development. Despite the numerous advantage of introducing ICT in secondary school, Aduwa and Iyamu observed that there has been steady decline in government's budgetary allocation to education. They also identified other factors hindering the adoption of ICT in secondary schools in Nigeria to include; high cost of computer hardware and software; weak infrastructure; lack of human skills and knowledge in ICT and lack of relevant software, appropriate and culturally suitable to Nigeria. The authors concluded that to integrate computer into teaching and learning in Nigeria, there must be proper and adequate

funding and financing of education by government with international bodies.

Williams et al. (2007) carried out a case study on enabling and constraining ICT practice in secondary schools in South Africa. The case study was done in 12 out of the 13 secondary schools in Grahamstown in the Eastern Cape in South Africa. This study addressed the issue of ICT implementation in secondary schools and focused on the practices that enable or constrain the successful implementation of ICT for teaching and learning activities. School principals and designated IT teachers were interviewed and on-site infrastructure audits conducted. The study identified a number of key and enabling factors surrounding practical issues, including sufficient hardware and affordable connectivity, sufficient technical support and training, policy-related issues such as the role of the national, provincial and school policy, the vital contribution of principal leadership and champion teachers as well as ongoing teacher professional development coupled with a willingness to change.

In Gambia, the Ministry of Education in conjunction with World Bank equipped half of the state secondary schools with state-of-the-art networked computer labs, but internet access remained a major obstacle to using these to their full potential (Mangesi, 2007). Similar challenges in terms of inconsistent connectivity, high costs and low connectivity speed are Africa-wide problems. Mangesi noted that another African country such as Sierra Leone, a country still recovering from civil war of the 1990s, does not have strong ICT initiatives or policies for schools. Likewise, the penetration level of ICT in Zambia's education institutions remains low with schools that are mostly using secondhand and refurbished computers (Isaacs, 2007). Rwanda has a strong government support for ICT development which has increased dramatically over the last decade (Farrel, 2007).

Farrel reports that in the year 2000, only one school had a computer, while six years later, over half of the country's primary and secondary schools had been equipped with computers. Farrel noted that in Uganda, a number of schools have computers and internet access; though some are not connected to the internet and some schools lack electricity.

Baokye and Banini (2008) measured teachers' readiness for use of ICT from schools in Benin, Cameroon, Ghana and Mali with the objective of determining if the teachers were involved in the process of integrating ICT into education in these countries. Teachers were asked about their skills with regard to ICT and use of ICT in pedagogical practices. Of the teachers questioned, 71% had never used a computer in class while 44% had never used it in preparing lesson notes. Despite the fact that some teachers did not use ICT at all, they agreed generally that computers had changed the way students learn.

Literature review reveals that African countries have insufficient ICT infrastructure. Many of her teachers are yet to adopt ICT in teaching and learning. Lack of proper and adequate funding for ICT resources remains the major impediment in its quest for technological advancement in education. Other challenges include absence of ICT policy or its implementation, high costs of internet connectivity and lack of electricity among others. The ICT situation in Kenya's secondary schools is a replica of what is happening in other African countries.

Adoption of ICT in education: The Kenyan perspective

ICT has outperformed all other segments of the Kenyan economy, growing by over 20% annually over the last 10 years (Momanyi, 2011). ICT has undoubtedly become one of the prime drivers of growth in Kenya and its opportunities in educational institutions

abound. With ICT increasingly playing a central role in the classroom, the digital divide is growing between urban and rural schools which are disadvantaged as majority lack electricity. Many public schools do not have computers since the government has not provided them. Most of the schools which have computers were donations from NGOs and other stakeholders hence they lack proper computer laboratories and technical support. Other impediments include high cost of internet provision, costs associated with ICT equipment, inadequate infrastructure and insufficient financial support in the light of high level of poverty in the country. These impediments have slowed the application of computer technology in Kenyan secondary schools.

2.3.1 MOE's Policy on ICT

Computer education was formally introduced in public secondary schools in 1996 so that the students could learn computer literacy skills. MOE published a policy and curriculum guidelines in 1997 approving the teaching of computer education in secondary schools. The MOE noted that computer education was to be included in the school timetable and teaching materials were developed at KIE and supplied to schools. Following the recommendations of the Koech Report of 1999, the government through MOE formulated a policy framework for Education, Training and Research (Sessional Paper no.1 of 2005). This paper outlines government's plan for the governance of education sector in the 21st century. It points that, information and communication technology skills play a key role in promoting economic development of a country (GOK, 2005). Many of the productivity gains in the developed world economies over the past two decades can, to a great extent be attributed to the impact of ICT.

The Government of Kenya appreciates and recognizes that, an ICT literate workforce is the foundation on which Kenya can acquire the status of a knowledge economy. Against this background, the Government will make education the natural platform for equipping the nation with ICT skills in order to create a dynamic and sustainable economic growth. Information and communication technology has a direct role to play in education and if appropriately used, ICT can bring many benefits to the classroom and the education and training process in general. It will provide new opportunities for teaching and learning including offering opportunity for more student centered teaching, opportunity to reach more learners, greater opportunity for teacher-to-teacher, and student-to-student communication and collaboration, greater opportunities for multiple technologies delivered by teachers, creating greater enthusiasm for learning amongst students and offering access to a wider range of courses. The Ministry's policy on ICT education is to integrate ICT education and training into education and training systems in order to prepare the learners, and staff of today for the Kenyan economy of tomorrow therefore enhancing the nation's ICT skills (GOK, 2005).

In the policy framework, the MOE set a number of specific objectives to be achieved. Key among the objectives was the development of a national ICT education policy; promotion of an expanded use of ICT for effective management, research and development at all levels of education; and provision of computers to secondary schools and teacher training colleges. Other objectives include the facilitation of universal access to ICT infrastructure (power, equipment and improved connectivity) in all institutions of learning, development of software instructional materials to support e-learning and reduction of the cost of ICT equipment (GOK, 2005).

Consequently, the Government formulated the national ICT policy in 2006. The policy aims to improve the livelihoods of Kenyans by ensuring the availability of accessible, efficient, reliable and affordable ICT services. Pertaining education, the government will encourage the use of ICT in schools, colleges, universities and other educational institutions in the country so as to improve the quality of teaching and learning (GOK, 2006). The aim was to provide sufficient internet capacity for schools, colleges, and to provide a reliable and secure internet infrastructure so that e-learning is boosted. The government planned to make education the platform for equipping the nation with ICT skills in order to create a dynamic and sustainable economic growth.

In 2007, the government developed Vision 2030 which aims at improving ICT in education. Kenya Vision 2030 is a vehicle for accelerating the transformation of Kenya into a rapidly industrializing, middle income nation by the year 2030. Under education and training, Kenya will provide a globally competitive quality education, training and research for development. To that extent, Kenya will incorporate science technology and innovation (STI) in education curricula. The education and training curricula in the country will be reformed at length to ensure that the creation, adoption, adaptation and use of STI become an integral part of the country's education. STI will be mainstreamed into the curriculum hence integrating instructional technologies into content and delivery at all levels. ICT flagship programs include the establishment of a computer supply program that will equip students with modern IT skills (GOK, 2007).

It is clear that MOE's policies on ICT are prudent and positive. Therefore, the government should have been fully committed to its implementation. Apart from supplying computers to teacher training colleges and some secondary schools, other ICT

policy promises were reneged. Most of the secondary schools were not supplied with computers and teachers were not trained hence this did not go well with the adoption of ICT. The schools which have computers were donations from NGOs and other stakeholders. Even where computers are available, the ratio of students to computers remains high hindering effective use of ICT. Many schools are handicapped by lack of electricity since the government has not been able to facilitate rural electrification for immediate ICT implementation.

2.3.2 Adoption of ICT in secondary schools

Introducing new technologies into places of learning should involve a fundamental shift whereby the role of teachers becomes less didactic and more that of facilitating individual learning process (Wagner et al., 2005). The changing nature of literacy underscores the importance of professional development for literacy and technology integration (Watts-Taffe & Gwinn, 2007). Teacher knowledge is instrumental in influencing how students use digital technologies in school (Brinkerhoff, 2006). An absence of professional quality development often leads teachers to use digital resources in non-innovative ways that will not develop new literacies, because they do not know how to use these technologies effectively in other ways (Scott & Mouza, 2007). Unfortunately, this lack of teacher knowledge often results in students using digital technologies to practice basic skills rather than to acquire skills beyond basic knowledge (Watts-Taffe & Gwinn, 2007).

The government recognizes the role played by the various institutions providing ICT education and training. However, there is need to strengthen and streamline the training through promoting ICT in education at primary, secondary, tertiary and community levels

by developing ICT curricula and ensuring that teachers/trainers possess the requisite skills; setting up a framework for evaluating and certifying ICT training programmes; developing a mechanism for attracting and retaining skilled human resources; establishing networks for sharing training resources; and developing strategies to support research and innovation (GOK, 2006).

With the introduction of ICT, the teaching-learning process will change and new skills for the teacher and the learner should be developed (Bradley, 2010). However, research shows that secondary schools in Kenya have not embraced computers in their curriculum (Inyega & Mbugua, 2005). Oloo (2009) did a baseline survey for ICT in secondary schools in selected parts of Kenya. He noted that majority of teachers were ill-equipped to effectively integrate ICT in the school's teaching and learning environment. Oloo discovered that the main challenge for teachers is lack of adequate computers, educational applications, training, policy and strategy on how integration of ICT should be done. There is a wide range of use of computers in the schools surveyed. Administrative use and examination processing remains the most frequent followed by teaching of basic computer skills. A few schools had purchased school management software which is used with varying success. The most common modules bought by schools were examination, timetabling and accounting. Use of computers for teaching and learning remains dismal with a 7.14% performance as reported by Oloo.

Thairu (2009) notes that ICT is a newly acknowledged resource which diversifies the source of knowledge and learning. He argues that there is need to regulate computer education to ensure standards and geographical coverage. Wanami (2010) found that the Kenyan Government has encouraged secondary schools to integrate computers in the

curriculum with modest gains. Wanami explains that policies on the use of computers in the classroom have been formulated and tax incentives in the importation of IT resources given but glaring constraints abound.

Presently, there are a number of challenges facing access and use of ICT in Kenya which include; high levels of poverty that hinder access to ICT facilities, limited rural electrification and frequent power disruptions. Where there is electricity, high costs of internet provision, high costs associated with ICT equipment, infrastructure and support (GOK, 2005). Kenyan secondary schools have acquired computers through many means including donations from politicians and other goodwill gestures, but many of these computers have gathered dust in their heavily fortified computer rooms that are put on display for visitors (Wanami, 2010). Wanami further notes that schools which use computers for learning and administration, usually under-utilize them. Emphasis should be placed on provision of support infrastructure, such as energy and roads; supporting software development; promotion of local manufacture and assembly of ICT equipment and accessories; and provision of incentives for the provision of ICT infrastructure (GOK, 2006).

There are a number of organizations that support the adoption of ICT in Kenyan secondary schools which include the following among others;

- i. Computer for Schools Kenya (CSFK); which collects refurbishes and redistributes used computers to Kenyan secondary schools. CFSK is also helping teachers, school principals, volunteers and other stakeholders acquire computer training. It is prolonging computer lifespan by applying “thin client” technology, which

minimizes the need for up-to-date desktop computers by having servers handle most processing. CFSK has distributed computers to various public institutions across Kenya, including rural or disadvantaged secondary schools, homes for street children, community resource centers and educational institutions for students with special needs.

- ii. Kenya SchoolNet, 2003; which facilitates the development of a national school Net's education network, which form "education backbone" for national development in the application of ICTs. Specifically it deals with connecting Kenyan schools, empowering Kenyan teachers and engendering ICTs in education.
- iii. ICT Trust Fund; which is a registered public private partnership consortium of stakeholders in education in Kenya. Formed in 2004 with the aim of spearheading ICT initiatives in education by mobilizing funds and in-kind resources for the purpose of setting up computer laboratories and providing ICT materials, curriculum and content in all Kenyan secondary schools through various implementing agencies such as NICE.
- iv. Non-Governmental Network Initiative for Computer in Education (NICE); which is an umbrella agency whose members are non-governmental organizations involved in the introduction and use of ICTs in schools.

ICT capacity is characterized by an ability to use effectively ICT tools and information sources to analyze, process and present information, and to model, measure and control external events (Dore & Wickens, 2004). A greater challenge is when students know

more about computer operation than their teachers. There is a gap between ICT expectations or aspirations and the actual ICT adoption in secondary scenario. Computers benefit people and play an important role in this information age. They impact in many areas including the education system. Because of their huge impact for our daily life, the educational function and advantages of computer use are gradually attracting the attention of service providers in the education sector.

According to GOK (2005) the adoption of new and emerging technologies by schools and classrooms offers even more reason to be hopeful. With sufficient access and support, teachers will be better able to help their students comprehend difficult-to-understand concepts and engage in learning, provide their students access to information and resources, and better meet their students' individual needs. Shiberu, Moro, Awanga and Matar (2008) point that e-learning has reared its head in the way teachers prepare and deliver lessons. They explain that digital teaching does not substitute the teacher in a classroom, but helps the teacher bring various concepts to life. Oboko, Wagacha, Omwenga and Odotte (2009), contend that the internet has revolutionized the lives of people around the world. Many services have been available courtesy of the internet. One of the services is web-based learning, which is used to educate students in schools.

It is however noteworthy to appreciate that the teacher has to know the various levels of performance of an ICT component. Besides, the user has to possess appropriate technical knowledge on the functioning of ICTs. In this condition, the user and the item used was found to agree and therefore help the user (teacher) bring reality into the classroom, the administrator use data for policy and the student explores the wide world of knowledge (Wanjala, Kagambe & Odek, 2008).

When computers are involved, teacher professional development programmes must address not only teacher's technical skills, but also their concerns about logistics, about how to use computers with students, and about risks to their status in the classroom.

Successful computer-supported or computer-focused programmes provides teachers with hands-on opportunities to build technical skills and work in teams while engaging them in activities that have substantial bearing on their classroom practices or other aspects of the school workplace (Gaible & Burns, 2005). Changes in technology provide new entry points for students into the discourse of education and give teachers new tools to help students make meaningful connections with their out-of school experience (Voogt & Knezek, 2008). There is need to introduce a comprehensive reform of the curriculum, teaching materials and assessment procedures which are aligned to ICT usage (Li & Walsh, 2010).

It is believed that specific uses of ICT can have positive effects on student achievement when ICTs are used appropriately to complement a teacher's existing pedagogical philosophies (Voogt & Knezek, 2008). A shift in the role of a teacher utilizing ICTs to that of a facilitator does not obviate the need for teachers to serve as leaders in the classroom; traditional leadership skills and practices are still important (especially those related to lesson planning, preparation and follow-up). Teacher lesson planning is vital when using ICTs; where little planning has occurred; research shows that student work is often unfocused and can result in lower attainment (Trucano, 2005). Nevertheless, teachers are advised to continue upgrading themselves with new information in the teaching profession after training as knowledge is progressive (Abdullahi, Samupwa & Alzaidiyeen, 2009).

2.3.3 Teacher characteristics, attitudes and principal's ICT leadership

Teacher characteristics as represented by gender, age, subject area and academic qualification formed the independent variables of the study. Teacher's gender is a variable that is useful in studying educational matters (Neimanis, 2001). Gender is defined as the economic, social, political and cultural activities and opportunities associated with being male and female (Desprez-Bouanchaud, Doolaee & Ruprecht, 1987). Males and females are in fact quite similar in most, though not all, psychological variables (Hyde, 2005). It is therefore difficult to account for educational differences between the sexes as based on biology because the pattern of sex differences is often unstable across cultures, across time within cultures, and also through time in the development of children (Arnot, David & Weiner, 1999).

Age is a variable which influences teaching and learning outcomes. Zigama (2010) found that age had influence on the attitudes of primary school teachers towards ICT. Studies in other fields found age to be a significant factor. For instance, age is theorized to be important in the adoption of health innovations such as family size planning (Mayanja, 2001) and agricultural innovations (Basisa, 1999).

Secondary school teachers are trained to specialize in two subject areas. The teaching subjects include English, Kiswahili, German, French, Mathematics, Biology, Chemistry, Physics, History, Geography, CRE, Computer studies, Agriculture, Business studies, Electricity, Drawing and Design, Woodwork and Music. The subject area of a teacher is a variable that has a bearing on pedagogical issues. Souter (2004) found that science teachers were confident in using ICT.

Teachers' academic qualification is another variable which has implications on quality of teaching and learning in secondary schools. Academic qualifications for teaching secondary schools in Kenya start with diploma holders and above. Specifically, it includes trained diploma, untrained graduate, trained graduate and trained postgraduate teachers. Teachers' qualifications play an important role in teaching because they influence instructional competence (Rotumoi, 2005).

Teacher's attitude is a variable that greatly affects instructional outcomes. Attitude is a predisposition to respond favorably or unfavorably to an object, person or event (Ajzen, 1988). Attitudes are inferred from what a person says about an attitude object, from the way he feels about it and from the way he says he will behave towards it (Ongeti, 1986). Zhang (2007) found that teachers' perception of ICT reform efforts is closely related to certain variables such as level of knowledge and attitude towards ICT. Chou (1997) reported that computer experience influenced teacher attitudes towards computers. Many studies dealt with teachers' attitudes towards use of computers (Cavas, Cavas, Karaoglan & Kislal, 2009; Fullan, 1992; Teo, 2008). Some researchers reported that teachers showed positive attitudes towards computer use in teaching and instruction (Lau & Sim, 2008; Zigama, 2010).

The school principal is a strategic leader who plays a prominent role in the management of the planning process (Jackson, 2005). The school head teacher more than any other individual, is responsible for the school climate, outcomes of productivity and staff (Konchari, 1988). The principal is the pivot around which many aspects of the school revolve (Bakhda, 2006). The entire process of introducing technology in any organization requires leadership (Mentz & Mentz, 2003).

2.3.4 Teacher characteristics and adoption of ICT

Teachers' background characteristics such as gender, age, subject area and academic qualification were necessary in determining their adoption of ICT. This information was useful in finding the nature of the respondents of the study and also for testing hypotheses on these variables. There is a digital divide in access and use of ICTs because of socio-cultural and economic factors such as gender, age, income and education around the world (ITU, 2003). A large number of studies have focused on finding the role of teachers' personal characteristics and demographic variables such as age, gender, and years of teaching experience in their ICT use in the classroom (Robinson, 2003; Bebell, Russell & O'Dwyer, 2004). Among other factors, teacher related variables are the most powerful predictors of technology integration (Becker, 2000). Many studies have produced an extensive overview of these teacher related factors (Mumtaz, 2000; Tondeur et al., 2008).

Francis and Pelton (1996) found a significant relationship between gender and computer use. Berg, Hestflatt, Nordi and Sorensen (2002) opine that the use of ICT is higher for male than female respondents. On the other hand, Olalere (2005) reported that male and female secondary school teachers have similar degree of ICT competence and proficiency. It is strongly supported by Rahimi and Yadollahi (2011) who found no significant relationship between gender and ICT use. Poynton (2005) supported this view and contends that the old stereotypic gender divide in terms of ICT use in teaching is closing in the 21st century.

Different experiences of different age groups may entail disparity in adoption of ICT among secondary school teachers. Young teachers may have been exposed to computers as part of their high school or college studies while older teachers may have had limited exposure to computers. Blankenship (1998) found that age was the most important demographic variable affecting computer use and attitude. Ehikhamenor (1999) found age to have no influence on ICT cognition.

Teachers' training and their subject area have a bearing on adoption of ICT in secondary schools. Rotumoi (2005) notes that teachers' qualification plays an important role in teaching because they influence instructional competence and may also determine existence of instructional problems in specific subjects. Roggers (1995) suggests that an individual's educational level affects his/her adoption of an innovation. It seems reasonable that the higher the educational level, the more familiarity an individual may have with the new technologies. Large scale innovations require large-scale teacher training (Pelgrum, 2001). Research shows that computer training significantly increases computer confidence and computer liking (Knezek, Christensen & Rice, 1997). Thus the question of whether teachers' background characteristics affected adoption of ICT among secondary school teachers in Baringo North District remained to be answered.

2.3.5 Teacher attitudes and adoption of ICT

Attitude is an individual's positive or negative feeling towards performing a behavior. Teachers' attitudes towards ICT are mental processes which stem from the beliefs, experiences and value judgments over computer use in education, in which individual views and feelings towards ICT use are evaluated (Zigama, 2010).

Teachers play an important role in the implementation of ICT into schools and their attitudes have proved to be significant predictors of technology use (Al-Zaidiyeen, Mei & Fook, 2010). People's attitude towards a new technology is a key element in its diffusion (Roggers, 1995). Teacher's attitude towards use of ICT is a key factor for the success of the ICT adoption in schools (Al-Zaidiyeen et al., 2010). Researchers from different parts of the world believe the use of ICT tools for educational purposes depends upon the attitudes of teachers towards technology (Albarini, 2004; Huang & Liaw, 2005; Teo, 2008).

Teachers' attitudes towards ICT can determine the extent to which technologies are used in the process of teaching and learning. The attitude towards computer use is generated by an individual's salient beliefs about the consequences of continued use and his evaluation of these consequences (Al-Zaidiyeen et al., 2010). Summers (1990) pointed that teachers' existing attitudes, skills and working habits will have great influence on their acceptance, style of implementation, and outcome of using computers for teaching. Attitude influences the implementation of computers in schools (Fullan, 1992). Some teacher related factors such as attitude towards ICT, ICT related knowledge and skills, and motivation to use ICT can be influenced (Afshari, Bakar, Su Luan, Samah & Fooi, 2009).

A study by Cavas and Keserzioglu (2003) aimed at investigating science teachers' attitudes towards Computer Assisted Learning (CAL). The results showed that majority of science teachers had positive attitudes towards CAL. Woodrow (1992) reported correlations between computer experience and attitudes towards technology. Teachers' negative attitudes towards computers change after receiving formal training about

computer use (Dupagne & Krendel, 1992). According to Davis (1989), the attitude of an individual is not the only factor that determines his use of a system, but is also based on the impact that it may have on his performance. Teachers who perceive technology as a tool to make work easier portray minimal resistance to the use of ICT in teaching and learning. This is what Davis calls “Perceived ease of use”, which he explains as the users’ perception of the amount of effort needed to use the system. It is measured in terms of how clear and understandable the interaction with the system, and ease of use of the system.

2.3.6 Principal’s ICT leadership and adoption of ICT

Instructional leadership from principals is important in the adoption of ICT among secondary school teachers. There is need for sustained high level ICT instructional leadership and championship at school level to provide oversight, inspiration and political goodwill. Effective leadership should facilitate the mobilization of resources needed to develop an ICT environment that is conducive for its swift adoption (GOK, 2006). School management can motivate the use of ICTs in their schools through moral support and providing adequate facilities and sustained maintenance of computers (Rono, 2011).

Principals who are ICT literate are able to lead by example in ICT adoption. Voogt and Knezek (2008) identified three levels of tasks that an educational leader can use to gauge performance using a computer as ICT component. First, are the routine tasks such as opening a file, deleting, creating, editing, printing, saving a document, moving files from one place to another in a computer. Second are internet tasks such as attaching a file to an e-mail message, writing and sending an e-mail, copying or downloading files from the

internet, and downloading music from the internet. Third, are the high-level tasks such as creating a multi-media presentation, constructing a web page, use database to produce a list of addresses, plot a graph using spreadsheets, use software to find and get rid of viruses. Teachers are greatly motivated to embrace technology when their principals have a command in the use of ICT.

Kouzes and Posner (2007) identified five practices that differentiated effective from ineffective leaders, which include: challenging the process, modeling the way, inspiring a shared vision, enabling others to act and encouraging the heart. Berends, Bodily and Nattaray (2002) found that effective and supportive principal leaders were most likely to increase and deepen the implementation of school improvement initiatives. Ross and Gray (2006) affirm that principals who adopt transformational leadership style have a positive impact on teacher beliefs in collective capacity and commitment to organizational values.

A study was done on the integration of ICT in Malaysian secondary schools so as to determine the presence or non-presence of the eight conditions suggested by Ely, that when present in the school environment will facilitate the integration of ICT in the teaching and learning process (Khalid et al, 2009). The findings of the study indicated that in general only three of the conditions were found to be most present namely; commitment by those involved, leadership and presence of knowledge and skills. The other five conditions namely; rewards or incentives, availability of resources, dissatisfaction with the status quo, participation, and time were present at a lesser degree in the schools. The results of correlational analysis among conditions suggest that a strong significant positive relationship exist between conditions 'presence of leadership' and

‘commitment by those involved’.

Successful implementation of computers can only occur if administrators offer teachers support and leadership. Lem (2003) remarks that principals need to be leaders, not only to manage the change in school, but also to create a culture where teachers and learners can thrive and adapt to the dynamic world. Administrators have to put in place proper facilities and help solve all the problems that may occur during its implementation (Wanami, 2010). The school head and other educational administrators at various levels carry out varying tasks which include curriculum and instruction, pupil personnel supervision, staff personnel guidance, school community relation, provision and maintenance of physical facilities and financial management (Olembo, Wanga & Karagu, 1992).

Another important role of the school principal is that of decision making. Bakhada (2006) comments:

The head teacher should be involved in making most of the decisions in the school. It is therefore important that the head teacher is a leader, a thinker and a decision maker. The head teacher manages finances, allocates budgets to various departments, leads academic innovations and sets out the administrative structure. (p.34).

The school principal has the responsibility under the direction of the Board of Governors (BOG), with the collaboration of in-school management team and teaching staff, for the initiation of the planning process, creation of a climate conducive for collaboration, the motivation of staff, establishment of infrastructure, the organization of activities and resources, the arrangement of consultations, communication and approval of procedures,

management of plans, implementation and evaluation (Jackson, 2005).

A baseline survey reports that school administrators recognized the need for the incorporation of ICT in school administration and other activities (Oloo, 2009). Although principals supported government policy on use of computers, they felt that more needed to be done regarding funding so as to increase the accessibility of ICT to all secondary schools (Odera, 2011). When the principal and top management of a school are behind ICT innovation, chances are high that the implementation process will be successful (Bird, 1996). Bird found out that head teachers who had positive attitude towards introduction and use of ICT and supported the idea, stimulated their implementation in their schools than those who did not.

Some schools are ahead of others because resource mobilization is determined by strategy put in place and head teachers' leadership skills (Kaliny, 2011). School leadership is crucial to outcomes (Dumpster, Lovett & Fluckiger, 2011). Teachers are more willing to adopt new technology if they gained support at different levels, for example, technical support, support from school leaders and encouragement from peers (Li & Walsh, 2010). Principals need to modify the existing traditional practices of teaching and learning since ICT has brought about changes, and teachers are not the ones who should be coping and implementing these changes; the leaders must take a huge step forward and take on this daunting task of change (Lem, 2003). Therefore, principal's ICT leadership has a great bearing on the adoption of ICT among secondary school teachers.

2.4 Impact of adoption of ICT on education

During the last decade, information and communication technologies have been introduced in a dynamic way in society and in a far lesser degree in education. Formal education (Primary, secondary or higher education) or informal education of various modes (professional training, lifelong learning) is all affected by ICT. The government of Kenya has gone into encouraging and financing integrated training to bridge the human resource gap in ICT (Thairu, 2009). Whereas earlier technologies provided teachers with a tool for continuing to teach in a manner they were already teaching, technologies such as e-mail and the internet shift more responsibility to the students to seek information and interact with people at other locations (Masinde, 2008).

Experiences on the ground tell us that when ICT components are incorporated into education, the possibilities and results are compelling (Figueroes, Senmartin & Eugelink, 2009). The authors further note that experiences with projects in Africa and Latin America encouraged them to confirm the lasting impact ICT can have on the ground. Although challenges abound, including a lack of political willingness to share information, inadequate infrastructure, skills shortage, and scarce resources; they report that the local impact of the projects implemented so far has a special added value. Trucano (2005) notes that the introduction of ICTs in educational systems has been used as an important mechanism and driver for educational reform efforts in some countries. There are grounds to believe that ICT will improve education since ICT can be used as a substitute for almost anything in class; pencil, book, telephone, television, map, encyclopedia, library and many more (Figueroes et al., 2009).

The introduction of new technologies and methods into learning environments provides opportunity to open up education to a range of other innovations. ICTs are technologies designed to enhance the flow of information and communication. They open up education more widely, and creates valuable opportunities for all those involved in education to reconsider their practices, and in so doing develop a more reflective approach to their activities (Wagner et al., 2005). The higher the adoption of ICT in education, the better the quality of learners leading to higher productivity. With the introduction of ICT, the teaching-learning process will change and new skills for the teacher and the learner should be developed. These ICTs can be utilized in many ways: as a level for organizational change, as a vehicle to introduce new teaching and learning practices and/or as an enabler of restructuring of the educational system (Trucano, 2005). ICT can be used to facilitate education-related data collection and processing efforts in ways previously not possible.

2.5 Chapter Summary

The chapter looked at the general literature related to the adoption of ICT in developed countries like USA and UK followed by the literature on the adoption of ICT among emerging economies as represented by Malaysia. Literature related to the adoption of ICT in Africa and particularly Kenya, the focus of this research is also reviewed. A review of literature has revealed that African countries still lag behind in the adoption of ICT compared to the developed countries. The studies in the literature indicated that attitudes towards adoption of ICT and Principal's ICT leadership have an impact on the adoption of ICT among secondary school teachers. Various studies highlighted in the chapter further revealed that teachers' characteristics such as gender, age, subject area

and academic qualification are paramount in the use of ICT but did not establish the relationship between these variables and the adoption of ICT in Baringo North District. This is the gap that this study intended to fill. This research therefore sought to investigate the adoption of ICT among secondary school teachers in Baringo North District.

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

3.0 Introduction

The study endeavored to investigate the adoption of ICT among secondary school teachers in Baringo North District in Baringo County. Specifically, the study sought to investigate the relationship between teacher characteristics and adoption of ICT among secondary school teachers. Adoption of ICT was the dependent variable of the study. The independent variables of concern in the study were age, gender, subject area and academic qualification. These variables were investigated to establish their influence on adoption of ICT among secondary school teachers. The study also sought to establish teacher attitudes towards adoption of ICT and the influence of principal's ICT leadership on the adoption of ICT among secondary school teachers. This chapter thus presents the research design and the methodological procedures that were used to carry out the study. It entails the research design, study area, population of study, sample size and sampling technique, instrumentation, data collection procedures, data analysis, ethical considerations and a summary of chapter three.

3.1 Research Design

Kerlinger (2002) defines research design as the plan, structure, and strategy of investigation conceived so as to obtain answers to research questions and to control variance. Kerlinger notes that it is invented to enable the researcher to answer research questions as validly, objectively, accurately, and economically as possible. This study was conducted through descriptive survey design. The design was chosen because it

would enable the researcher to establish and describe the state of affairs as it exists at present concerning the problem at hand (Kothari, 2009).

According to Mugenda and Mugenda (2003), a survey is a self-report study which requires the collection of quantifiable information from the sample. Further, Koul (1984) notes that surveys are conducted to collect detailed descriptions of existing phenomena with the intent of employing data to justify current conditions and practices or to make more intelligent plans for improving them. In addition, survey research studies large and small populations (or universes) by selecting and studying samples chosen from the populations to discover the relative incidence, distribution, and interactions of sociological and psychological variables. Surveys are concerned with hypothesis formulation and testing the analysis of the relationship between non-manipulated variables (Kothari, 2009).

The study employed the survey design since the researcher wanted to get the precise information and make conclusive results regarding adoption of ICT in secondary schools. Survey could be descriptive, exploratory, or involving advanced statistical analysis. It provides an accurate descriptive analysis of characteristics of a sample which can be used to make inferences about the population or universe (Kerlinger, 2002). Therefore descriptive survey design was seen as appropriate in this study.

The researcher used mixed methods approach (both qualitative and quantitative strategies) so as to maximize the strengths and minimize the limitations of each approach. Qualitative research seeks to describe and analyze the culture and behaviour of humans and their groups from the point of view of those being studied (Kombo & Tromp, 2006).

Quantitative research includes designs, techniques and measures that produce discreet, numerical or quantifiable data (Mugenda & Mugenda, 1999).

3.2 Study Area

The study was carried out in Baringo North District in Baringo County, Kenya. The District is bordered to the north by Baringo East District; to the east by Marigat District, to the south by Baringo Central District and to the west by Keiyo and Marakwet Districts. Administratively, the District is divided into four divisions namely; Kabartonjo, Barwesa, Kipsaraman and Bartabwa divisions with 14 locations. The District is classified into three agro-ecological zones namely; highlands (suitable for agricultural activities), midlands (inhabited by agro-pastoralists) and lowlands (mainly for livestock rearing). It receives an annual rainfall ranging between 1,000mm to 1,500mm with mean annual temperatures of 25°C at highland while lowlands receive an average annual rainfall of 600mm with temperatures above 32°C. Over 70% of the District is considered arid and semi-arid lands (ASALS) while 8% is suitable for farming. High poverty rates, food insecurity and poor infrastructure characterize the District (Action Aid, 2006).

3.3 Population of the Study

Baringo North District had 20 public secondary schools of which 15 had introduced computers. Only 11 public secondary schools had computers which had been in use for at least one year. The researcher set a criterion that allowed only secondary schools that had used computers for at least one year to participate in the study. This measure was taken to ensure that principals and teachers who participated in the study have had a reasonable exposure time on the use of computers. Consequently, only 11 public secondary schools

were legible as they met the criterion set. The target population comprised 11 public secondary schools which had used computers for at least one year. All the 11 principals and 131 teachers were targeted.

3.4 Sample Size and Sampling Technique

According to Kothari (2009), sampling refers to the selection of some part of an aggregate or totality on the basis of which a judgment or inference about the aggregate or totality is made. Kathuri and Pals (1993) recommends the use of 30% of the target population to form a sample. Simple random sampling was used in selecting a representative sample for the study. Oso and Onnen (2008) justify that simple random sampling ensures that each member of the target population has an equal and independent chance of being included in the sample.

Consequently, samples of eight public secondary schools out of the 11 targeted public secondary schools were selected using simple random sampling technique. The sample comprised of eight principals and 94 teachers. Therefore, the total sample size used in this study was 102 respondents. The distribution of the schools sampled and the respondents of the study are summarized in Table 3.1.

Table 3.1: Distribution of the schools sampled and respondents

Category	Total	Selected
No. of schools with computers that had been used for at least one year	11	8
No. of principals in the schools	11	8
No. of teachers in the schools	131	94
Total respondents		102

The researcher administered questionnaires to 94 public secondary school teachers and interviewed 8 principals. Therefore the study had a final tally of 102 respondents.

3.5 Instrumentation

Oso and Onen (2008) opine that instrumentation refers to the tools to be used for collecting data and how those tools were developed. The researcher used two types of tools namely; questionnaire and interview schedule.

3.5.1 Questionnaire

Kothari (2009) observes that quite often, questionnaire is considered as the heart of survey operation. On the other hand, Koul (1984) defines a questionnaire as a device consisting of a series of questions dealing with some psychological, social, educational, etc; topic(s): sent or given to an individual or a group of individuals, with the object of obtaining data with regard to some problems under investigation. Koul notes that questionnaires are widely used in educational research to obtain information about certain conditions and practices, and to inquire into opinions and attitudes of an individual or a group. Cohen, Manion and Morvison (2000) adds that questionnaires are widely used and

useful instrument for collecting survey information, providing structured, often numerical data, being able to be administered without the presence of the researcher, and often being straightforward to analyze. A questionnaire was developed for teachers.

3.5.2 Scoring of the questionnaire

The questionnaire was divided into four sections numbered 1 to 4. Section 1 of the questionnaire dealt with demographic characteristics of the respondents. The section mainly consisted of closed ended questions. Section 2 of the questionnaire dealt with the level of ICT adoption in teaching and learning. This section consisted of a four point scale in which respondents were required to indicate their level of ICT adoption in teaching and learning. The four point scale comprised very competent (VC), competent (C), somehow competent (SC) and not competent (NC).

Section 3 dealt with teachers' attitudes towards adoption of ICT in teaching and learning. This section consisted of a five point likert-type scale in which the respondents were required to indicate their level of agreement. The five point scale comprised strongly agree (SA), agree (A), undecided (U), disagree (D), and strongly disagree (SD). Each of the items in this section had the five alternatives from which the respondents were asked to tick against only one. Some of the items were stated as if to imply positive or favorable responses while others were presented as if to imply negative or unfavorable responses. For purposes of analysis, numbers were assigned to the responses as follows; SA=5, A=4, U=3, D=2 and SD=1 for positive statements while SA=1, A=2, U=3, D=4 and SD=5 for negative statements. A total of 6 statements each were stated positively and negatively. Section 4 of the questionnaire required the respondents to give their views or comments

about their principal's ICT leadership. This section consisted of open ended questions.

3.5.3 Interview Schedule

An interview schedule is a device consisting of a set of questions which are asked and filled in by an interviewer in a face to face situation with another person. This helps the researcher to explain the nature and purpose of the investigations and to make the meaning of the questions clear to the respondents if they misinterpret a question or give incomplete or indefinite responses. It ensures almost all respondents complete and give usable returns (Koul, 1984). An interview schedule instrument was used to collect data from school principals.

3.6 Validity and Reliability of the research instrument

3.6.1 Validity of the Research instruments

Validity refers to the extent to which an instrument measures what it purports to measure. It deals with how accurately the data obtained in the study represents the variables of the study. It therefore implies that validity is the accuracy and meaningfulness of inferences which are based on the research results (Mugenda & Mugenda, 1999). Assistance was sought from the researcher's supervisors and other research experts in the school of education, Moi University, to standardize the tools of research. Their input was used to improve the clarity of items on the questionnaire used in the study.

3.6.2 Reliability of the Research instruments

According to Kombo and Tromp (2006), reliability is a measure of how consistent the results from a test are. If you administer a test to a subject twice do you get the same score on the second administration as you did on the first? The reliability of the test is the

answer to this question. In addition, Kerlinger (2002) emphasized that reliability is the dependability, stability, consistency, predictability, and accuracy. It is the accuracy of a measuring instrument. In this respect, pilot study was done by pre-testing the questionnaires using two schools in the neighbouring Baringo Central District. The purpose of the pilot study was to enable the researcher improve the reliability of the instrument and to familiarize with its administration.

A Cronbach alpha coefficient was used to determine the reliability. As pointed by Mugenda and Mugenda (1999), a Cronbach alpha reduces the time to compute a reliability coefficient in other methods and also, its application results in a more conservative estimate of reliability. Therefore a reliability coefficient of 0.7 and above proves the reliability of the instrument and implies that the items correlate highly among themselves; hence there is consistency among the items measuring the concept of interest.

From the pilot study, a reliability coefficient of 0.8104 was obtained which proved that the instrument was reliable. The pilot phase helped to determine the clarity or ambiguity of items and the level of language that the study used. Items which received a low 'undecided' frequency and a low ambiguity index were deemed suitable in the final questionnaire while the unsuitable items were those which received high 'undecided' responses and high ambiguity index. Some items of low reliability were improved while the rest were not used in the final questionnaire.

3.7 Data Collection Procedure

The researcher obtained an introduction letter from Moi University and a research permit from the Ministry of Higher Education through the National Council for Science and Technology. Authorization letters from Baringo North District Education Officer (DEO) and District Commissioner (D.C.) were used for accessing the schools. Before data collection, prior visits to selected schools were made for purposes of booking appointments with principals and teachers. Then the researcher personally delivered the research instruments, administered and collected them for analysis.

Questionnaires were administered starting from January 30th 2012. Teachers were given enough time to complete the questionnaires. Principals were interviewed on the same days that the questionnaires were distributed to the teachers. Data collection was concluded on February 23rd 2012 when the researcher had collected a total of 94 copies of the questionnaire and interviewed eight principals. The respondents were assured of confidentiality in the information provided while responding to the items on the questionnaire and the interview schedule.

3.8 Data Analysis

The data collected from the questionnaires was analyzed using descriptive and inferential statistics. Descriptive statistics such as frequencies, percentages and means were used for the purpose of comparison and description. Inferential statistics used include Chi-square test and regression analysis. A Chi-square test for difference tests a null hypothesis that the relative frequencies of observed events follow a specified frequency distribution. The Pearson Chi-square test for difference was used to analyze statistical significance in the sample on the independent variables and the dependent variable of the study. The

significance level was set at 0.05. Regression analysis is often used to determine the effect of independent variables on a dependent variable. It measures the relative impact of each independent variable and is useful in forecasting. Regression analysis was performed to establish the predictive value of the independent variables on the dependent variable of this study. All statistical analyses were computed using Statistical Package for Social Sciences (SPSS) computer programme.

Information obtained from the interview schedules were recorded and organized into themes according to the research objectives. Thereafter, interpretive statements that captured respondents' answers were written. The responses were also tabulated on frequency tables, counted and converted into percentages which were used in comparisons and descriptions.

3.9 Ethical Considerations

The researcher encountered sensitive information that revealed deficiencies in ICT matters in the sampled schools. He explained to the respondents the purpose of the study, those selected for the study, methods used in collecting data, how confidentiality was guaranteed and the importance of the findings. The research study was reported in such a way that data was not linked to a specific respondent or secondary school. The researcher assured the respondents of confidentiality of the source of the collected data thus research principles of privacy and confidentiality of respondents was adhered to. The researcher got approval from the Ministry of Higher Education through the National Council for Science and Technology. The head teachers were informed of the exercise through a letter prior to the start of the study. Permission was sought from other relevant authorities

including the District Education Officer and the District Commissioner for Baringo North District.

3.10 Summary of Chapter Three

The research design, study area, population of the study, sample size and sampling procedure, instrumentation, validity and reliability, data collection procedure, data analysis and ethical consideration were discussed in this chapter. The design selected was descriptive survey research design. The study area was Baringo North District and the sample size was 102 respondents. Questionnaire was the main instrument for data collection while data analysis utilized both descriptive and inferential statistics. The dependent variable of the study was adoption of ICT among secondary school teachers while the independent variables were age, gender, academic qualification and subject area. The research design and methodology chosen helped the researcher to collect data, analyze, interpret, discuss findings, and draw conclusions and recommendations in chapters four and five in the thesis report.

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS, INTERPRETATION AND DISCUSSION

4.1 Introduction

This chapter presents the results of both the descriptive and inferential statistical analysis of the data. The data collected using the instruments was analyzed and a summary of analysis presented in this chapter. Interpretation of analyzed data and a discussion of findings were also presented in this chapter. The chapter is structured to cover the introduction, background information, teacher characteristics and adoption of ICT among secondary school teachers, attitudes towards adoption of ICT, principals' ICT leadership, and finally a discussion of the findings.

The objectives that guided this study included; to establish whether there was any significant relationship between teacher characteristics and adoption of ICT among secondary school teachers, to investigate the attitudes of secondary school teachers towards adoption of ICT and to determine the influence of principal's ICT leadership on the adoption of ICT among secondary school teachers. Both descriptive and inferential statistics were used in data presentation. Five hypotheses of the study were tested using chi-square test (χ^2), performed at 0.05 level of significance, and regression analysis.

The results of the chi-square from the SPSS output were used to make a decision on whether to reject or accept the null hypotheses. Acceptance implied that the stated null hypothesis was true while rejection meant going against the null hypothesis. Interpretation was made based on the findings obtained. The conclusions were drawn from the decision made on the hypotheses. This was done by first stating the hypothesis

followed by a presentation of the results and interpretation of the findings based on the decision made on the hypothesis.

4.2 Background Information

The presentation of background information is divided into; background characteristics of the teachers, teacher's basic information on ICT and profiles of school principals.

4.2.1 Background characteristics of the teachers

The purpose of this section was to obtain information on the demographic characteristics of the teachers of secondary schools in Baringo North District. Descriptive statistics are presented followed by the results of hypothesis testing on the variables that employed the chi-square test and regression analysis. The respondents were required to provide information on gender, age, teaching subjects, academic qualification and teaching experience. This information was useful in finding the nature of the respondents of the study and also for testing hypotheses on these variables.

The gender of the respondents comprised 67% for male and 33% for female. Their ages showed that 30 years and below were 46.8%, 31-40 years were 36.2%, 41-50 years were 13.8% while 51 years and above were only 3.2%. The subject areas that respondents predominantly taught had sciences leading with 33%, followed by languages at 25.5%, then humanities at 20.2%, mathematics at 10.6%, technical and applied at 9.6% and finally computer studies at 1.1%. On academic qualification, 71.3% were trained graduate teachers, 22.3% were trained diploma teachers, 5.3% were trained postgraduate teachers and only 1.1% was an untrained graduate teacher. Their teaching experience showed that 11.7% had taught for less than one year, 42.6% had taught for between one

and five years, 17% had taught for between six and ten years, 20.2% had taught for between eleven and twenty years while 8.5% had taught for over twenty years. Table 4.1 shows a summary of teacher characteristics of teachers.

Table 4.1: Distribution of freq. and percentages of teacher characteristics

Variable	Category	Frequency	Percent.(%)
Gender	Male	63	67
	Female	31	33
Age	30 years and below	44	46.8
	31-40 years	34	36.2
	41-50 years	13	13.8
	51 years and above	3	3.2
Subject area	Languages	24	25.5
	Sciences	31	33
	Mathematics	10	10.6
	Humanities	19	20.2
	Computer	1	1.1
	Tech. & Applied	9	9.6
Academic qualification	Untrained diploma	0	0
	Untrained graduate	1	1.1
	Trained diploma	21	22.3
	Trained graduate	67	71.3
Teaching experience	Trained postgraduate	5	5.3
	Less than 1 year	11	11.7
	1-5 years	40	42.6
	6-10 years	16	17
	11-20 years	19	20.2
Total	Over 20 years	8	8.5
	23 items	94	100 (each variable)

4.2.2 Teacher's basic information on ICT

In section one of the questionnaire, respondents were given four closed ended questions that dealt with basic information on ICT. The sixth question on the questionnaire concerned the number of computers in their schools and the specific location of the computers accessed by the respondents both for personal and school use. 37(39.4%) of the teachers indicated that they accessed computers mainly from the school computer lab,

12(12.8%) accessed them at the school staffroom, 8(8.5%) accessed computers from the principal's office, 16(17%) accessed them from the HOD's offices, 14(14.9%) had own personal computer or laptop, 5(5.3%) accessed computers at commercial cyber café and 2(2.1%) accessed computers in other places that they specified as secretary's office and school library. Adeya (2002) noted that computers in schools are in the principals' offices being used for office work and not for learning, teaching and instructional purposes.

The seventh question on the questionnaire posed to the respondents was if they had attended any training, workshop or seminar on using computers. 20(21.3%) indicated that they had not attended any training, workshop or seminar on using computers while 74(78.7%) said that they had attended. Despite the high exposure to computers, majority of the teachers are still incompetent because ICT adoption is not a one off event but requires daily use for its skills to be internalized. Teachers' lack of comfortable and convenient access to ICT resources remains a major impediment to their competency on ICT tools. Locations such as principal's office cannot offer favorable environment for learning ICT. Depending on the number of computers in the school, locations such as the computer lab and school staffroom may promote teacher's accessibility to ICT resources.

The eighth question on the questionnaire was a follow up on the seventh question. It required those who had attended training, workshops or seminars on using computers, to specify where they were trained. 19(20.2%) received computer training through school workshop or sponsorship, 37(39.4%) were taught computer skills at college or university while 18(19.1%) financed themselves at commercial computer colleges.

Individual teacher initiatives such as financing their acquisition of computer skills and purchasing own laptop or computers help in cementing ICT competence.

The ninth question on the questionnaire required teachers to give the number of years that they had been using computers. 69(73.4%) indicated varying years which were less than ten while the rest 25(26.6%) reported using computers for different years which were 10 years and above. Years of computer use determines teacher's efficiency in ICT matters.

4.2.3: Profiles of school principals

All the eight principals of the sampled schools participated in the study. Table 4.2 shows the profiles of the principals who responded to the interview schedule.

Table 4.2: Profiles of the principals from the sampled schools

Variable	Category	Frequency	Percent.(%)
Gender	Male	5	62.5
	Female	3	37.5
Age	Less than 31 Years	0	0
	31-40 years	1	12.5
	41-50	7	87.5
	More than 50 years	0	0
Length of service	Less than 11 years	0	0
	11-20	6	75
	More than 20 years	2	25
Length of stay in current station	Less than 6 years	4	50
	6-10 years	1	12.5
	11-20 years	2	25
	More than 20 years	1	12.5

As illustrated in Table 4.2, 5(62.5%) of the respondents were male while 3(37.5%) were female. Their ages were found in two groups, majority 7(87.5%) were aged 41-50 years and only 1(12.5%) was aged 31-40 years. Their length of service in the teaching profession was represented as 6(75%) having served 11-20 years and 2(25%) for over 20 years. On the status of station mobility, 1(12.5%) had stayed in the current station for more than 20 years, 2(25%) had stayed for 11-20 years, 1(12.5%) had stayed for 6-10 years and 4(50%) had stayed for less 6 years.

4.3 Level of adoption of ICT among secondary school teachers

This section intended to establish the level of adoption of ICT among secondary school teachers in teaching and learning. It was a manifestation of teachers' ICT competence. This section had relations with ICT competence scale which was adapted from Algozzine and Flowers (2000). The definition of competence by Algozzine and Flowers is shown in the Table 4.3.

Table 4.3: Definition of ICT Competence.

Scale	Definition
Very Competent	Can teach others how to perform a task
Competent	Can complete a task
Somehow Competent	Can perform a task with assistance
Not Competent	Cannot perform a task

It was used to measure secondary school teachers' perceived competence in ICT in Baringo North District. Respondents were asked to rate their perceived competency in basic computer applications which include operating word processing, power point

presentation, spreadsheets, databases, internet, educational software and removing viruses.

Word processing is a computer skill for typing, making notes and presenting texts in many formats. PowerPoint presentation is a major skill used by teachers when making lesson presentations in the classroom. Spreadsheet software is used by teachers to develop records, mark sheets and student progress records. It is used for managing student grades and results. Databases are found in the form of subject content since schools can develop their own databases and other Microsoft access tools. The internet has unlimited information for use in the classroom. There are various educational softwares that have been developed for teaching and learning that require teachers' evaluation skills before they are used in the classroom. Removing computer viruses require technical knowledge and experience in computer use.

All the seven items were measured on a four point rating scale comprising not competent (NC), somehow competent (SC), competent (C) and very competent (VC). Teachers' responses are shown on Table 4.4.

Table 4.4: Distribution of frequencies and percentages on ICT competence scale

Description of level of ICT adoption	Frequencies and Percentages (%) in brackets.			
	NC	SC	C	VC
Operate word processing(e.g.ms word)	7 (7.4)	23 (24.5)	44 (46.8)	20 (21.3)
Operate a presentation (e.g.ms PowerPoint)	19 (20.2)	31 (33)	36 (38.3)	8 (8.5)
Operate spreadsheet (e.g.ms excel)	21 (22.3)	29 (30.9)	37 (39.4)	7 (7.4)
Operate a database (e.g.ms access)	30 (31.9)	35 (37.2)	25 (26.6)	4 (4.3)
Use internet for educational research and updates	23 (24.5)	15 (16)	35 (37.2)	21 (22.3)
Select and evaluate educational software for teaching and learning	27 (28.7)	30 (31.9)	29 (30.9)	8 (8.5)
Remove computer viruses	48 (51.1)	20 (21.2)	19 (20.3)	7 (7.4)
	25 (26.6)	26 (27.7)	32 (34.0)	11 (11.7)
Overall	51 (54.3)		43 (45.7)	

Note. NC-Not Competent, SC-Somehow Competent, C-Competent and VC-Very Competent.

Table 4.4 indicated that majority of the teachers considered themselves to be incompetent (either not competent or somehow competent in the scale) in five out of seven items. A higher proportion of the respondents perceived themselves to be less competent in spreadsheets (46.8%), databases (30.9%), presentations (46.8%), using educational software (39.4%) and removing computer viruses (27.7%). Most of their rating fell between the range of ‘Not competent’ and ‘Somehow competent’ which reflect incompetence in computer use. Respondents felt least competent in removing computer viruses (27.7%). Removing computer viruses using antivirus programs is a technical area that needs to be learned by teachers. This result is in agreement with that of Wanami

(2010) who found teachers to be incompetent in spreadsheets, presentations, databases, among other computer functions.

The two items that teachers were more competent (either competent or very competent on the scale) are word processing (68.1%) and internet use (59.5%). The result is in agreement with the findings of Lau and Sim (2008) who found teachers to be most competent in word processing compared to other applications. Slaouti and Barton (2007) concluded that the ICT that is most commonly used by teachers was word processing and the World Wide Web. Further, Becker, Ravitz and Wong (1999) found that word processing software and World Wide Web browsing were the most commonly used applications by teachers regardless of the subject they taught.

The overall percentages of teachers' responses on the ICT competence scale were 26.6% for Not Competent, 27.7% for Somehow Competent, 34.0% for Competent and 11.7% for Very Competent. This shows that majority of the respondents (54.3%) were incompetent (either not competent or somehow competent) in handling most of the computer functions. ICT competence of teachers were rated on a four point scale comprising 'Not Competent' (1), 'Somehow Competent' (2), 'Competent' (3) and 'Very Competent' (4). The mean scores of the statements on computer competence are shown in Table 4.5.

Table 4.5: Mean scores of statements on computer competence

Description of level of ICT adoption	Mean (x)
Operate word processing(e.g.ms word)	2.8
Operate a presentation (e.g.ms powerpoint)	2.4
Operate spreadsheet (e.g.ms excel)	2.1
Operate a database (e.g.ms access)	2.0
Use internet for educational research and updates	2.6
Select and evaluate educational software for teaching and learning	2.2
Remove computer viruses	1.8
Overall	2.2

The results revealed that the statements on ICT competence had an overall mean of 2.2 showing that teachers were incompetent in using ICT.

The findings showed that majority of the teachers (54.3%) were incompetent in handling most of the computer functions. The low overall mean of 2.2 is a further confirmation of teachers' incompetence in handling ICT. This is in line with the findings of Lau and Sim (2008) who report that despite the apparent benefits of the use of ICT, the learning potential of ICT is deprived as many teachers are still not fully ICT literate and do not use it in their teaching. The teachers' limited computer competence is a direct consequence of their lack of access, training, administrative support and time among others.

4.3.1 Gender and adoption of ICT among secondary school teachers

Desprez-Bouanchaud et al. (1987) defined gender as the economic, social, political and cultural activities and opportunities associated with being male and female. They posit that in most societies, men and women differ in the activities they undertake, in access to and control of resources, and in participation in decision making. According to Hill Collins (1990), women have occupied different (and usually subordinate) positions historically because western and other societies are patriarchal, that is, that men have power over women and therefore are in a position to interpret so called biological differences in stereotyped ways. Neimanis (2001) supported gender mainstreaming in education which includes gender equality in enrolment and completion rates, structural equality within the teaching profession and the addressing of gender stereotypes in school curricula and teacher education.

Hyde (2005) holds that males and females are in fact quite similar in most, though not all, psychological variables. It is therefore difficult to account for educational differences between the sexes as based on biology because the pattern of sex differences is often unstable across cultures, across time within cultures, and also through time in the development of children (Arnot et al., 1999). Gender is often cited as a factor having influence on ICT use (Madhusudan, 2002; World Bank, 1998).

In this study, a questionnaire was used to establish teachers' gender. The questionnaire was administered to 94 teachers in the sampled schools of which 63 (67%) were male while 31 (33%) were female. Figure 4.1 shows the gender distribution of teachers in the sampled schools.

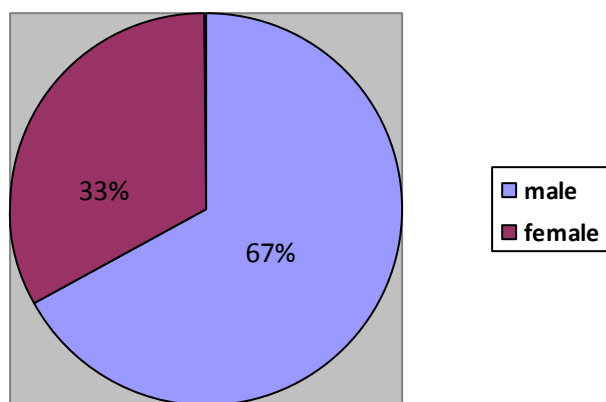


Figure 4.1 Gender Distribution of Teachers

Teachers' level of ICT adoption was rated on a three point scale comprising Not Competent, Somehow Competent and Competent (either Very Competent or Competent on the main questionnaire). A summary of teacher's gender and their level of ICT adoption in teaching and learning is shown in Table 4.6.

Table 4.6 Summary of teachers' gender and their level of ICT adoption

Gender	Not Competent	Somehow Competent	Competent	Total
Male	17 (18%)	17 (18%)	29 (31%)	63 (67%)
Female	8 (8%)	9 (10%)	14 (15%)	31 (33%)
Total	25 (26%)	26 (28%)	43 (46%)	94 (100%)

From Table 4.6, 26% of teachers were not competent in ICT while 28% of teachers were somehow competent in ICT. This meant that majority of teachers (54%) were incompetent in handling ICT matters. Only 46% of teachers were competent in using ICT for teaching and learning purposes.

Hypothesis one sought to establish whether there was any significant relationship

between gender and the adoption of ICT among secondary school teachers. It was stated as;

Ho₁: There is no significant relationship between gender and the adoption of ICT among secondary school teachers

A chi-square test was performed at 0.05 level of significance and the results are recorded in Table 4.7.

Table 4.7: Chi-Square Test on gender and adoption of ICT.

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	2.222(a)	3	.528
Likelihood Ratio	2.366	3	.500
Linear-by-Linear Association	.210	1	.647
N of Valid Cases	94		

From Table 4.7, Pearson chi-square test (χ^2) indicated that there was no significant relationship between gender and adoption of ICT ; $\chi^2 (3, n=94)=2.222, p > 0.05$. Hence the null hypothesis (Ho) was accepted and a conclusion was made that there is no significant relationship between gender and adoption of ICT. The findings of this study are in line with the findings of Olalere (2005) who reported that male and female secondary school teachers have similar degree of ICT competence and proficiency. It is strongly supported by Rahimi and Yadollahi (2011) who found no significant correlation between gender and ICT use. Also Poynton (2005) reported that the old stereotypic gender divide in terms of ICT use in teaching is closing in the 21st century. The findings disagreed with other studies that found gender as a strong determining factor to teachers'

computer literacy (Berg et al., 2002; Cornelliussen, 1997; Imhof, Vollmeyer & Beierlein, 2007; Sharpka & Ferrari, 2003).

4.3.2 Age and adoption of ICT among secondary school teachers

Ehikamenor (1999) found age to have no influence on ICT cognition. However, Schiffman and Kanuk (2004) observe that the age of consumer innovators is related to the product category in which the consumers innovate, with innovators tending to be younger than late adopters. Age is theorized to be important in the adoption of health innovations such as family size planning (Mayanja, 2001). Age is also theorized to be important in the adoption of agricultural innovations (Basisa, 1999). Basisa found out that while older farmers may have more experience and farm resources thereby having strong incentives to try out emerging technologies, young farmers might have more schooling and exposure to new ideas that may help in the adoption of new technologies. Zigama (2010) found age as a significant predictive factor of primary school teachers' attitude towards ICT in education in Rwanda.

The results of this study showed that 46.8% of the teachers were aged less than 30years, 36.2% were aged 31-40 years, 13.8% were aged 41- 50 years and 3.2% were over 50 years. Figure 4.2 shows a summary of the ages of teachers in the sampled schools.

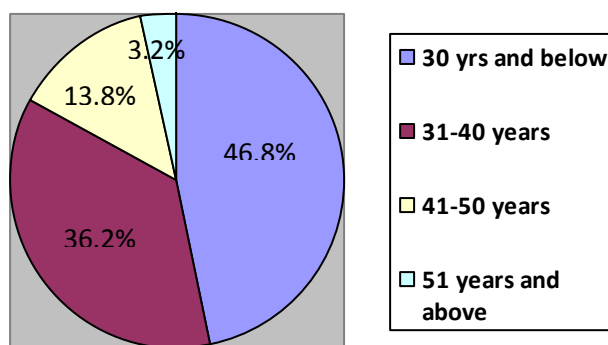


Figure 4.2: Distribution of Teachers' Ages

Teachers' level of ICT adoption was rated on a three point scale comprising Not Competent, Somehow Competent and Competent (either Very Competent or Competent on the main questionnaire). A summary of their responses on ICT competence item is shown in Table 4.8.

Table 4.8: Summary of teachers' ages and their Adoption of ICT

Age in years	Not competent	Somehow Competent	Competent	Total
Less than 30	7 (7%)	12 (13%)	25 (27%)	44 (47%)
31-40	11 (12%)	8 (8%)	15 (16%)	34 (36%)
41-50	5 (5%)	6 (6%)	2 (2%)	13 (14%)
More than 50	2 (2%)	1 (1%)	0 (0%)	3 (3%)
Total	25 (27%)	27 (29%)	42 (44%)	94 (100%)

The results show that 25(27%) teachers aged less than 30 years were competent while none of the teachers aged over 50 years was competent in handling ICT. This showed that

younger teachers were more competent in using ICT than their older colleagues.

Hypothesis two sought to establish the relationship between teacher's age and adoption of ICT. The hypothesis was stated as follows;

Ho₂: There is no significant relationship between teacher's age and adoption of ICT among secondary school teachers

The results of the chi-square test are shown in Table 4.9.

Table 4.9: Chi-Square Test on age and adoption of ICT

	Value	df	Asymp. Sig. (2- sided)
Pearson Chi-Square	26.286	9	.002
Likelihood Ratio	26.116	9	.002
Linear-by-Linear Association	18.041	1	.000
N of Valid Cases	94		

From Table 4.9, the Pearson chi-square showed that a significant relationship existed between age and the adoption of ICT; $\chi^2 (9, n=94)=26.286, p < 0.05$. Hence the null hypothesis (Ho) was rejected and a conclusion was made that there is a significant relationship between teachers' age and adoption of ICT among secondary school teachers. This is because younger teachers were more competent in using ICT than their older colleagues. This finding agreed with recent researchers who reported that ICT use decreases with age and that younger teachers incorporate ICT tools into their teaching more than their older counterparts (Innan & Lowther, 2010; Rahimi & Yadollahi, 2011). The study is also in consonance with the findings of Blankenship (1998) who found out that age was the most important demographic variable affecting computer use. In

addition, another study found that teachers of elderly age are not open to new technology like ICT in developing countries (Jennings & Onwuegbuzie, 2001). This finding on the contrary, is at variance with a study done by Ehikhamenor (1999) who found age to have no influence on ICT cognition.

4.3.3 Subject area and adoption of ICT among secondary school teachers

In subject area, teachers were categorized in terms of languages (English and Kiswahili teaching subjects), mathematics, sciences (Biology, Chemistry and Physics teaching subjects), humanities (History, Geography and CRE teaching subjects), computer studies, and technical and applied (Agriculture, Business studies, Electricity, Drawing and Design, Woodwork and Music). The outcome of a study done by Thomas and Martz (2006), reported that there was a considerable difference in computer literacy level of teachers based on their subject discipline.

On the contrary, Becker et al. (1999) found that word processing software and World Wide Web browsing were the most commonly used applications by teachers regardless of the subject they taught. The Eurobarometer Benchmarking Survey by Empirica (2006) stated important areas of current computer use by teachers across Europe. The survey indicated that teachers teaching science, mathematics and computer science (22%) and active in vocational education (23%) are the most intensive users of computers in class. This compared to only 5% of literature and language teachers and with 13% for those in humanities and social science among others. Oludipe (2004) reported that there existed a low level of acquaintances with many computer packages among science teachers in Nigeria contradicting findings of the same year by Gray and Souter (2004) who posit that

science teachers in Scotland were reasonably confident in their use of ICT.

The subject area of teachers in the sampled schools was established and the results reflected upon. Figure 4.3 summarizes the results of the findings on teachers' subject area.

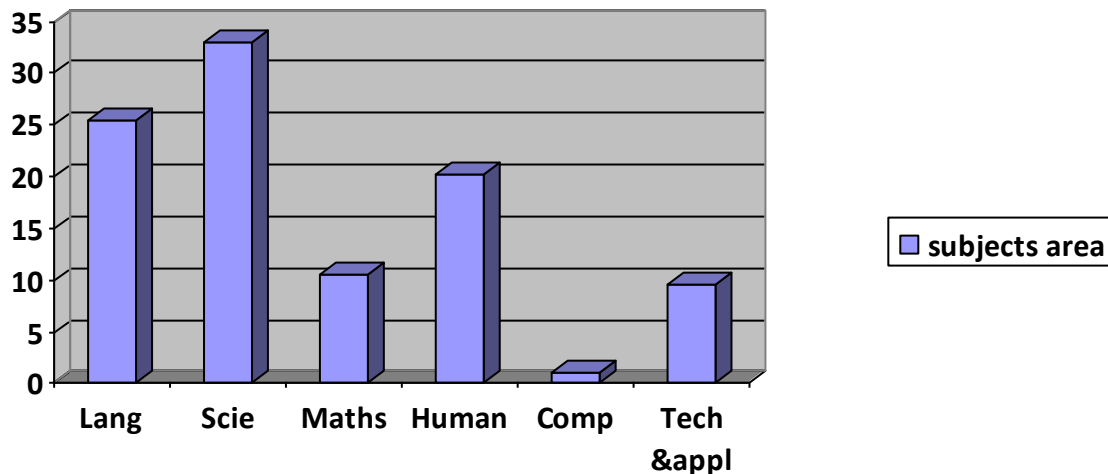


Figure 4.3: Teachers' Subject Area

Lang- Languages

Maths- Mathematics

Tech & Appl- Tech & Applied subjects

Scie- Sciences

Human- Humanities

Comp- Computers

The results indicated that 24% taught languages, 31% taught sciences, 10% taught mathematics, 19% taught humanities, 1% taught computer studies and 9% taught technical and applied subjects. The subject area of a teacher was necessary to establish its influence on the adoption of ICT. Teachers' level of ICT adoption was rated on a three point scale comprising Not Competent, Somehow Competent and Competent (either Very Competent or Competent on the main questionnaire).

Table 4.10 summarizes their responses on adoption of ICT.

Table 4.10: Summary of Teachers' Subject Area and in of ICT

Subject area	Not Competent	Somehow Competent	Competent	Total
Languages	7 (7%)	7 (7%)	10 (11%)	24 (26%)
Sciences	6 (6%)	10 (11%)	15 (16%)	31 (33%)
Mathematics	2 (2%)	2 (2%)	6 (6%)	10 (11%)
Humanities	6 (6%)	5 (5%)	8 (8%)	19 (20%)
Computer	0 (0%)	0 (0%)	1 (1%)	1 (1%)
Tech. & Applied	4 (4%)	2 (2%)	3 (3%)	9 (10%)
Total	25 (26%)	26 (28%)	43 (46%)	94 (100%)

The findings show that the percentage of competent teachers in each subject area was distributed as follows; 11% for languages, 16% for sciences, 6% for mathematics, 8% for humanities, 1% for computers, and 3% for technical and applied. This indicated that except for computer studies, all other subject areas had more than half of the teachers being incompetent in using ICT. Overall, 46% were competent against 54% who were incompetent in handling ICT for teaching and learning.

Hypothesis three sought to find out the relationship between teachers' subject area and adoption of ICT among secondary school teachers. A null hypothesis was used to test this relationship which stated that;

H₀₃: There is no significant relationship between teachers' subject area and adoption of ICT among secondary school teachers

Table 4.11 shows the results of the chi-square test.

Table 4.11: Chi-Square Test on subject area and adoption of ICT

	Value	df	Asymp. Sig. (2- sided)
Pearson Chi-Square	23.118	15	.082
Likelihood Ratio	19.518	15	.191
Linear-by-Linear Association	.450	1	.502
N of Valid Cases	94		

From Table 4.11, the Pearson chi-square (χ^2) showed that there was no significant relationship between subject area and the adoption of ICT; $\chi^2 (15, n=94)=23.118, p > 0.05$. Hence a decision was taken to accept the null hypothesis and a conclusion was drawn that indeed there is no significant relationship between subject area and adoption of ICT among secondary school teachers. This result disagreed with the findings of Thomas and Martz (2006) who reported that there was a considerable difference in computer literacy level of teachers based on their subject discipline.

4.3.4 Academic qualification and adoption of ICT among secondary school teachers

Cheplogoi (2011) contends that the effectiveness and efficiency in teaching and learning are determined by teacher academic and professional qualification. Cheplogoi found a significant relationship between teachers' academic qualification and the attitudes towards agriculture with teachers of high academic qualification tending to favor agriculture more than teachers of low academic qualification. Teachers' computer skills

and education can be the most significant variable in predicting patterns of integrating ICT tools in the classroom (Hew & Brush, 2007; Innan & Lowther, 2010). MA holders use ICT tools more than BA holders (Rahimi & Yadollahi, 2011). They (Rahimi and Yadollahi) found a correlation between teachers' computer literacy and academic credentials. Other researchers reported discrepancies in teachers' technology literacy level in view of their degree or level of educational attainment (Atkins & Vasu, 2000).

Teachers were required to state their highest academic qualification from a variety of choices given. The results indicated that 21(22.3%) were trained diploma teachers, 1(1.1%) was an untrained graduate teacher, 67(71.3%) were trained graduate teachers and 5(5.3%) were trained postgraduate teachers as shown by figure 4.4.

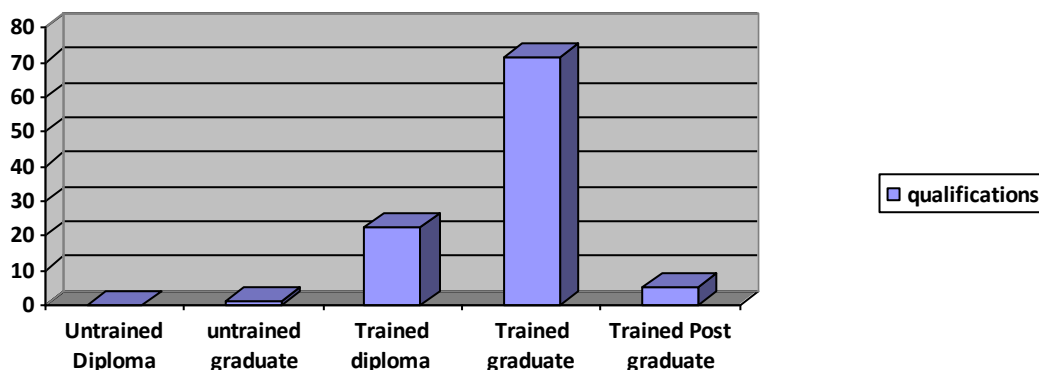


Figure 4.4: Academic qualification of teachers

Teachers' level of ICT adoption was rated on a three point scale comprising Not Competent, Somehow Competent and Competent (either Very Competent or Competent on the main questionnaire). Table 4.12 shows a summary of the academic qualification of the teachers and adoption of ICT.

Table 4.12: Teachers' academic qualification and adoption of ICT

Academic qualification	Not Competent	Somehow Competent	Competent	Total
Trained diploma teacher	7 (7%)	8 (8%)	6 (6%)	21 (22%)
Untrained graduate teacher	0 (0%)	0 (0%)	1 (1%)	1 (1%)
Trained graduate teacher	16 (17%)	18 (19%)	33 (35%)	67 (71%)
Trained postgraduate teacher	2 (2%)	0 (0%)	3 (3%)	5 (5%)
Total	25 (26%)	26 (28%)	43 (46%)	94 (100%)

The results show that competent teachers comprised 6% for trained diploma, 1% for untrained graduate, 35% for trained graduate and 3% for trained postgraduate teachers. Generally, only 46% of teachers were competent in using ICT. Thus, the majority (54%) were incompetent in using ICT.

Hypothesis four sought to establish the relationship between teachers' academic qualification and adoption of ICT among secondary school teachers. The hypothesis was stated as follows:

H₀₄: There is no significant relationship between academic qualification and adoption of ICT among secondary school teachers

Table 4.13 shows the results of the chi-square test.

Table 4.13: Chi-Square Test on academic qualification and adoption of ICT

	Value	df	Asymp. Sig. (2- sided)
Pearson Chi-Square	12.452	9	.189
Likelihood Ratio	14.239	9	.114
Linear-by-Linear Association	.388	1	.533
N of Valid Cases	94		

The results of the chi-square test (χ^2) indicated that there was no significant relationship between academic qualification and adoption of ICT; χ^2 (9,n=94)=12.452, $p>0.05 = 0.189$. Therefore a decision was taken to accept the null hypothesis that there is no significant relationship between academic qualification and adoption of ICT among secondary school teachers. The results show no mutual supportive relationship between ICT literacy level and the varying academic qualification attained by the various teachers who participated in the study. These findings are incompatible with those of Rahimi and Yadollahi (2011) who found a correlation between teachers' computer literacy and academic credentials. This is because teachers in the district had high academic qualifications as reported by a study done by Cheplogoi (2011) who revealed that the teachers of Baringo North district were professionally trained, with high academic qualification most of whom are experienced teachers in the profession.

4.3.5 The predictors of ICT adoption

In order to determine the proportion of the variance in the adoption of ICT that could be explained by the selected independent variables of the study, multiple regression analysis was performed. In a regression model, R square is used to describe the goodness-of-fit or

the amount of variance explained by a given set of predictor variables. The standard regression output provides information about the effects of individual predictor variables. Generally there are two types of information in the coefficient tables; coefficients and significance tests. The unstandardized coefficients indicate the increase in the value of the dependent variable for each unit increase in the predictor variable. The significance test evaluates the null hypothesis that the unstandardized regression coefficient for the predictor is zero when all other predictors' coefficients are fixed at zero. This test is presented as a t statistic.

Regression analysis test was carried on gender, age, subject area and academic qualification as independent variables with adoption of ICT as the dependent variable.

The hypothesis was stated as follows;

H₀₅: There is no significant difference between independent variables (gender, age, subject area and academic qualification) and adoption of ICT among secondary school teachers

The summary of the multiple regression results are presented in Tables 4.14a, b and c

Table 4.14a:Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.355(a)	.126	.076	.83921

a Predictors: (Constant), Academic qualification, Subject area, Gender, Age

Table 4.14b: ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8.929	5	1.786	2.536	.034(a)
	Residual	61.976	88	.704		
	Total	70.904	93			

a Predictors: (Constant), Academic qualification, Subject area, Gender, Age

b Dependent Variable: Adoption of ICT

Table 4.14c: Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients Beta	t	Sig.
		B	Std. Error			
1	(Constant)	1.610	.773		2.084	.040
	Gender	6.271E-02	.187	.034	.336	.738
	Age	-.542	.187	-.509	-2.899	.005
	Subject area	3.572E-02	.058	.063	.620	.537
	Academic qualification	.181	.165	.111	1.096	.276

a Dependent Variable: Adoption of ICT

The findings showed that Adjusted R square=.076 indicating that only 7.6% of the variance in the dependent variable is explained by the independent variables. From the findings, the study revealed that age, gender, subject area and academic qualification are not the only determinants of adoption of ICT among secondary school teachers. There are other factors determining adoption of ICT which may include home characteristics (family structure/composition), social/cultural perceptions, geography (rural/urban location) among others.

4.4 Attitude towards ICT

Attitude is a predisposition to respond favorably or unfavorably to an object, person or event (Ajzen, 1988). Attitude has three components namely; the cognitive component which is the idea used by people to think; the affective component which is the emotion that charges the idea such as feeling good or bad; and the behavioral component which is the predisposition to action such as admiring or disliking (Ongeti, 1986). An attitude held can manifest itself through behavior (Rotumoi, 2005). This study used the third component of attitude which is the predisposition to action such as admiring or liking ICT through studying the expressed opinions of the respondents as expressions of their attitudes.

The strong relationship between computer related attitudes and computer use in education has been emphasized in many studies (Sang, Valcke, Van Braak & Tondeur, 2010; Van Braak, Tondeur & Valcke, 2004). Teachers' beliefs have remained stable and their resistance to change is one of the main explanations behind the diminutive adoption of ICT in education (Haney, Czeniak & Lumpe, 1996). Computer experience influences teacher attitudes towards computers (Chou, 1997).

Another study by Cavas et al. (2009) found that almost all Turkish science teachers had positive attitudes towards ICT in education while Demetriadis et al. (2003) explored teacher 'technophobic' attitudes about ICT in science teaching. Lau and Sim (2008) report that teachers showed positive perceptions on computer use in teaching and instruction. Zigama (2010) found that teachers had positive attitudes towards ICT use in

education. Teachers who efficiently use technology in classroom teaching adopt positive attitudes towards ICT (Moseley & Higgins, 1999).

This section intended to establish the attitude of teachers towards adoption of ICT in secondary schools. A five point likert- type of scale was used to measure attitude in which statements were provided to the respondents from which they had to choose that which apply depending on the opinion of each respondent. A total of 12 statements were provided to the teachers which were stated to imply both positive and negative attitudes towards ICT. Where the statement was positively stated, a Strongly Agree response earned 5 points, Agree earned 4 points, Undecided earned 3 points, Disagree earned 2 points and Strongly Disagree earned 1 point. The negative statements were reverse coded. Frequency counts of responses from the respondents were recorded and presented in form of frequency tables. Table 4.15 shows the results of frequency counts on the positive statements.

Table 4.15: Frequency counts for positive statements

Statement	SA	A	U	D	SD	Total
Computers save time and effort	68	25	0	0	1	94
Computers can enhance students' learning	55	37	0	1	1	94
Using computer technology in the classroom would make the subject matter more interesting	54	34	0	2	4	94
Everyone can easily learn to operate a computer in the classroom	28	46	2	16	2	94
I have seen some teachers use computers for educational purposes in this school	23	40	4	14	13	94
Computers improve teacher's authority in the classroom	27	49	7	8	3	94

From the above frequency counts, it is clear that 93 (98.9%) teachers agree (a response of either Strongly Agree or Agree) that computers save time and effort. 92(97.9%) affirm that computers can enhance student's learning. Another 88(93.6%) teachers agreed that using computer technology in the classroom would make the subject matter more interesting. To support this, 76(80.9%) said that computers improve teacher's authority in the classroom while 74(78.7%) posit that everyone can easily learn to operate a computer in the classroom. Concerning the last positive statement, 63(67.0%) teachers agreed that they had seen some teachers use computers for educational purposes in their schools. Since majority of the teachers agreed with all the positive statements, it shows that they had positive attitudes towards the adoption of ICT. This finding is in agreement with that of Zigama (2010) who found that teachers had positive attitudes towards ICT use in education. Slaouti and Barton (2007) reported that ICT can motivate students in their learning by bringing variety into the lessons, and at the same time, sustaining teacher's own interest in teaching. The results of the frequency counts on the negative statements are provided on Table 4.16.

Table 4.16: Frequency counts of negative statements

Statement	SA	A	U	D	SD	Total
Learning about computers is a waste of time	0	0	0	13	81	94
Computers cannot improve the quality of students' learning	1	5	1	13	74	94
I would avoid using computers in the classroom as much as possible	1	3	3	28	59	94
It would be hard for me to learn to use computers in teaching	1	4	2	39	48	94
I have never seen computers being used as an educational tool in this school	11	13	5	25	40	94
Computers would weaken teacher's authority in the classroom	2	12	5	28	47	94

The findings show that all the 94(100%) teachers disagreed (a response of Strongly Disagreed or Disagreed) that learning about computers is a waste of time, implying that all teachers wanted more skills on computer use. 86(91%) disagreed that computers cannot improve the quality of students' learning while 87(93%) disagreed on avoiding computers in the classroom. Asked if it would be hard for them to learn to use computers in teaching, 87(93%) disagreed. Another 65(69%) disagreed that they had never seen computers being used as educational tool in their schools. Finally, 75(80%) disagreed that computers would weaken teachers' authority in the classroom. Generally, teachers disagreed with all the negative statements indicating that they had positive attitudes towards the adoption of ICT. Positive attitudes towards computers are important since it leads to increased computer competence (Chai, Hong & Teo, 2009).

4.4.1 Mean scores for the frequency counts from the statements

Mean scores for each statement was calculated together with the overall mean score for the entire negative and the positive statements on the five point likert scale. The mean scores represented the level of favorable feelings or unfavorable feelings for the respondents towards adoption of ICT. The mean scores range 3-5 for favorable feelings and 1-3 for unfavorable feelings. The mean scores were used to decide on the attitude of the respondents towards ICT. Table 4.17 shows the mean scores and the overall means for positive statements.

Table 4.17: Mean scores for positive statements

Statement	Mean(x)
Computers save time and effort	4.7
Computers can enhance students' learning	4.5
Using computer technology in the classroom would make the subject matter more interesting	4.4
Everyone can easily learn to operate a computer in the classroom	3.9
I have seen some teachers use computers for educational purposes in this school	3.8
Computers improve teacher's authority in the classroom	3.9
Overall mean	4.2

All the positive statements yielded individual means of over 3.0 with an overall mean of 4.2. Since the mean scores for favorable feelings range from 3-5, it indicates that the teachers' feelings towards the statements were in the favorable range and as such, teachers had positive attitude towards ICT. Empirical findings show that favorable attitude towards computers did positively and directly affect the degree of computer use in class (Van Braak et al., 2004).

The mean scores were calculated for each negative statement and the overall means of all the negative statements was obtained. Table 4.18 summarizes the results of the findings.

Table 4.18: Mean scores for negative statements

Statement	Mean(x)
Learning about computers is a waste of time	4.9
Computers cannot improve the quality of students' learning	4.6
I would avoid using computers in the classroom as much as possible	4.5
It would be hard for me to learn to use computers in teaching	4.4
I have never seen computers being used as an educational tool in this school	3.7
Computers would weaken teacher's authority in the classroom	4.1
Overall mean	4.4

The results revealed that all the negative statements yielded individual mean scores of more than 3.0 with an overall mean score of 4.4 implying that teachers' feelings were within the favorable range of means of between 3 to 5. Hence teachers had positive attitudes towards ICT since they disagreed with the negative statements.

The analysis of both the positive and the negative statements showed an average mean of 4.3 on a five point scale, implying that secondary school teachers had positive attitudes towards ICT. This is in line with the findings of Lau and Sim (2008) who found that teachers were positive with the use of ICT in school and appreciate the use of ICT in enhancing teaching and learning. Although teachers displayed positive attitude towards ICT, there were certain suggestions they seem to be communicating to schools in order to promote the adoption of ICT in teaching and learning. Some include increasing the ratio of computers to students, provision of reliable internet connectivity, acquisition of LCD projectors, school laptop computers and ICT in service for teachers. They were strongly against the proliferation of culturally inappropriate websites.

4.5 Principal's ICT leadership

This section sought to establish principal's ICT leadership skills and its influence on adoption of ICT among secondary school teachers. Konchari (1988) pointed that the school principal is the major component of school administration on whose ability, skill, personality and professional competence largely determines the efficiency of a school. Konchari says that the school head teacher more than any other individual, is responsible for the school climate, outcomes of productivity and staff. On the other hand, Mentz and Mentz (2003) suggest that the entire process of introducing technology in any organization require leadership while Rono (2011) found out that most schools in Kenya do not support teachers in their endeavors to use computers in performing school instructional tasks.

The school principal is a strategic leader who plays a prominent role in the management of the planning process. He has the responsibility under the direction of the BOG, with the collaboration of in-school management team and teaching staff, for the initiation of the planning process, creation of a climate conducive for collaboration, the motivation of staff, establishment of infrastructure, the organization of activities, and resources, the arrangement of consultations, communication and approval of procedures and the management of plans, implementation and evaluation (Jackson, 2005). When the principal and top management of a school are behind ICT innovation, chances are high that the implementation process will be successful (Bird, 1996). Bird found out that head teachers who had positive attitude towards introduction and use of ICT and supported the idea, stimulated their implementation in their schools than those who did not.

Objective 3 sought to find out the influence of Principal's ICT leadership on the adoption of ICT among secondary school teachers

Teachers were given two open-ended questions from which to freely respond concerning their school principal's ICT leadership. The principals were interviewed using an interview schedule containing eight questions of which five had choices while three were open-ended questions. The purpose of the interview schedule was to establish the influence of principal's ICT leadership on the adoption of ICT among secondary school teachers.

Teachers' responses on their principal's ICT leadership

Teachers were asked if they viewed their school principals to be supportive of teachers' computer use in teaching and learning. 72(76.6%) of the teachers said yes while 22(23.4%) of the teachers said that their principals do not support teachers' use of computers in teaching and learning. Those who said yes gave various reasons for their positive responses. Key among them was that the school principal had put up a computer lab, improved on teachers' access to computers (free during school hours), employed a computer trained personnel to coordinate ICT implementation, acquired relevant software for teaching and learning, acquired a LCD projector and a laptop for teachers' use in classroom instruction, acquired modern desktop computers and plans to buy more, installed a computer in the staffroom for teachers' use, has own laptop, and encourages teachers to have their own personal computers for ICT compliancy.

Other reasons for teachers' positive views include the fact that principals had acquired computers for key departments, campaigned for teachers to integrate technology in their pedagogy, motivated the ICT competent teachers to induct their incompetent colleagues, budgeted for ICT improvement and lobbied for computers which had been donated to the school. A few teachers mentioned that the principals had introduced computer studies in the school, led in ICT adoption by using it himself in classroom delivery, organized ICT workshop in the school, purchased software for exam analysis and lesson timetabling, sponsors teachers to attend workshops and seminars on computer skills and supports ICT through sensitization of emerging technologies by purchasing new innovations in the market.

The teachers who reported that their school principals do not support ICT in their schools gave reasons for their responses. Some teachers noted that their principals had put little effort in acquiring computer resources since their school had only three computers compared to other schools which had more than twenty. They accused their school head of being computer illiterate and unwilling to prioritize ICT programs. Other teachers opined that their principal viewed ICT implementation as an expensive venture yet he prioritized other projects like school bus which is more expensive. Lack of ICT support from principals was reflected in their bias on teacher sponsorship to ICT seminars, absence of a computer lab, inaccessibility to computers (computers are located in the administration offices which are not reached by teachers) and the fact that spoilt/faulty/obsolete computers are not repaired/replaced.

Form the above comments, principals who support ICT adoption among teachers in teaching and learning do so by providing conducive environments by which ICT implementation can thrive. Resources, however little they may be, must be allocated towards ICT development. The principal's ICT leadership indeed does influence the adoption of ICT among secondary schools. ICT competent principals led by example and this improved adoption levels among their teachers. This finding is in line with that of Bird (1996) who found out that head teachers who had positive attitude towards introduction and use of ICT and supported the idea, stimulated their implementation in their schools than those who did not.

4.5.2 Principal's interview schedule

All the eight principals of the sampled schools participated in the study. Apart from demographic characteristics as shown in profiles of principals in table 4.2, principals were also interviewed on the status of computers in their schools. Table 4.19 shows a summary of their responses.

Table 4.19: Status of computers in the sampled schools

Variable	Category	Frequency	Percent.
Number of functional computers	1-4	4	50
	5-9	0	0
	10-14	0	0
	15-19	1	12.5
	20-24	1	12.5
	Over 25	2	25
Availability of computer lab	Yes	4	50
	No	4	50
Source of computer funding	MOE	2	25
	School funds	4	50
	MOE and School funds	2	25

Table 4.19 shows that two schools had a high concentration of computers which numbered over 25, one school had 20-24 computers; another one school had 15-19 while the rest four schools had 1-4 computers. The number of computers in a given school dictates the level of computer competence, accessibility and ICT penetration in the station. Principal's ICT leadership is also mirrored in the number of computers in the school.

If the computers are many, then there is need for a computer lab which is the heartbeat of ICT in the school. 4(50%) schools had constructed a computer lab or improvised a classroom to serve the purpose while the rest 4(50%) had no computer lab. On the source of funding for the computers, two schools had been funded entirely by MOE, another two had been funded both from school funds and MOE while four schools had bought their

computers using school funds. A few schools had gotten computer donations which were not functional since they were either outdated or had been consumed by computer viruses.

The study found out that principals who were more competent in computer skills were an edge ahead of their colleagues in soliciting for computer sponsorship from the MOE and allocating school funds towards improvement of ICT in their schools. They were able to network and get computer funding for their schools. The schools that benefited from the MOE sponsorship showed that their principals' leadership image was a key attraction. A shining example in the district is the government's Economic Stimulus Programme (ESP) that sponsored five secondary schools in ICT program which entailed the supply of 11 desktop computers, one laptop, one LCD projector, one printer and internet connectivity. The survey showed that schools with more than 10 functional computers had a higher presence of ICT competent teachers.

Principals reported that teachers used computers in lesson preparation, storage purposes and in analysis of exams. Classroom instruction using ICT was minimal with a few teachers using an LCD projector scarcely. Reasons for this minimal computer use during lessons ranged from computer inadequacy, lack of time, lack of skills to lack of access among others. Teachers' use of computers can be facilitated by certain conditions which include positive attitudes among teachers and principals, ICT workshop, seminars or in service and technical assistance.

Mechanisms instituted by some school principals that supported teachers' use of computers include; facilitating ICT training for teachers, sponsoring teachers to attend ICT in service/seminars, embracing peer training where competent staff induct others and improving teachers' access to ICT resources. Two principals had installed internet connectivity for educational research and updates while another principal had encouraged teachers to acquire own laptops or personal computers.

The principals were asked to give their opinion on the future of ICT in teaching. Their responses include the idea that schools are shifting towards e-learning, e- admission, e-resources among others in the coming years. Others observed that in the near future, MOE will make it mandatory for teachers to be ICT compliant, and that ICT will fill the gap of staff inadequacy thus creating room for efficient curriculum delivery.

To enhance the use of computers in secondary schools in Kenya, the principals suggested that KIE should widen curriculum to include ICT lessons, the government should subsidize on computer accessories for schools, and MOE to post computer teachers to all secondary schools. Some principals suggested that the provision of tax waiver on importation of computers by schools should be implemented by the government. One principal appealed to MOE to fund ICT resources for all public secondary schools and not just a selected few as it is currently happening.

All the principals from the sampled schools showed positive attitudes towards the adoption of ICT. This agreed with the findings of Serhan (2007) who studied school principals' attitudes towards use of technology in United Arab Emirates and found that

the principals had positive attitudes towards the use of technology in teaching. He found out that they were willing to support the use of technology in their schools.

School principals in Kenyan schools are limited by their budgets. Therefore, their leadership in ICT matters varied significantly and this influenced the adoption of ICT among secondary school teachers. Championing the acquisition of ICT resources by principals is a requisite to adoption of ICT among secondary school teachers. As Wanami (2010) found out that successful implementation of computers can only occur if administrators offer support and leadership to the teachers. They (administrators) have to put in place proper facilities and help solve all the problems that may occur during its implementation.

4.6 Discussion of findings

Discussion of findings was based on the main objective of this study which endeavored to establish the adoption of ICT among secondary school teachers in Baringo North District.

4.6.1 Adoption of ICT in teaching and learning

The findings of the study revealed that teachers' level of ICT adoption was below bar as majority (54.3%) of them were incompetent in handling ICT resources. The low overall mean of 2.2 is a further confirmation of teachers' incompetence in using ICT. Secondary school teachers have not fully adopted ICT in teaching and learning. This result is in agreement with what Oloo (2009) found in his study on ICT in secondary schools in selected parts of Kenya. He noted that majority of teachers were ill-equipped to effectively integrate ICT in the school's teaching and learning environment.

This finding is also in line with the findings of Lau and Sim (2008) who report that despite the apparent benefits of the use of ICT, the learning potential of ICT is deprived as many teachers are still not fully literate in ICT and do not use it in their teaching. The teachers' limited computer competence is a direct consequence of their lack of access, training, administrative support and time among others. However the findings of this study contradicted Higgins (2003) findings on ICT use in UK schools who reported that majority of teachers and students use ICT.

The interpretation here implied that the objective of promoting ICT as enshrined in the MOE's Sessional Paper no.1 of 2005, remain a mirage. Universal access to ICT in Kenyan schools is still a dream. The attainment of vision 2030 pledge of creating, adopting, adapting and using STI(science, technology and innovation) as an integral part of the country's education may not be realized unless urgent steps are taken to mitigate the current scenario in Kenyan secondary schools.

Individual teacher initiatives such as financing their acquisition of computer skills and purchasing own laptop or personal computers help in cementing ICT competence. This is in line with the findings of Wanami (2010) who found that individual teacher initiatives accounts for much of the implementation of computer technology. The survey found out that some teachers lacked support from the administrators in their quest for ICT competency. This agreed with the findings of Morton (1997) who studied factors affecting the integration of computers in secondary schools in Sydney. Morton found out that lack of support by administrators was identified as a significant barrier towards

implementation of computers in classroom.

4.6.2 Teacher characteristics and adoption of ICT

The study explored the relationship between teacher characteristics and adoption of ICT among secondary school teachers in Baringo North District. A Chi-square test performed at 0.05 level of significance and regression analysis were the inferential statistics used to test the hypotheses of the study. Table 4.20 shows a summary of the results of hypothesis testing from the sampled schools.

Table 4.20: Summary of the results of hypothesis testing using Chi-square

Hypothesis	Degrees of freedom	Chi-square	p-value	Decision
Ho ₁ : There is no significant relationship between gender and the adoption of ICT.	3	2.222	.528	Accept the null hypothesis
Ho ₂ : There is no significant relationship between age and adoption of ICT.	9	26.286	.002	Reject the null hypothesis
Ho ₃ : There is no significant relationship between subject area and adoption of ICT.	15	23.118	.082	Accept the null hypothesis
Ho ₄ : There is no significant relationship between academic qualification and adoption of ICT.	9	12.452	.189	Accept the null hypothesis

As shown in Table 4.20, the chi-square results revealed that it is only teacher's age that had a statistical significance. There was no significant relationship between teachers' gender, subject area and academic qualification, and adoption of ICT among secondary school teachers.

The study revealed that gender and adoption of ICT had no statistical significance. This implies that female teachers are now closing the gap that existed between male and female teachers in the use of ICT. It seems clear that women have strengthened their relative position as users of ICT. The findings of this study are in line with the findings of Olalere (2005) who reported that male and female secondary school teachers have similar degree of ICT competence and proficiency. It is also in consonance with findings of Rahimi and Yadollahi (2011) who found no significant correlation between gender and ICT use. Further, Poynton (2005) found that the old stereotypic gender divide in terms of ICT use in teaching is closing in the 21st century. The findings disagreed with other studies that found gender as a strong determining factor to teachers' computer literacy (Berg et al., 2002; Cornelliussen, 1997; Imhof et al., 2007; Sharpka & Ferrari, 2003).

The results showed that teachers' age had a significant relationship with adoption of ICT. Teachers of younger age make more use of ICT in schools compared to their elderly counterparts. Young teachers, having been exposed to computers in high school or college/university, have greater computer skills to enhance their teaching and instructional practices. Teachers who had come out of Teacher Training Colleges and universities in the last five years seem to have taken computer proficiency courses from

the teacher training institutions or commercial colleges. This group of young teachers displayed pedagogical prowess and enthusiasm in computer use.

Since results of this study found teachers' age to be statistically significant at 0.02, it agreed with a recent study which reported that ICT use decreases with age and that younger teachers incorporate ICT tools into their teaching more than their older counterparts (Innan & Lowther, 2010). It is also in line with the findings of another study which found that teachers of elderly age were not open to new technology like ICT in developing countries (Jennings & Onwuegbuzie, 2001). This finding on the contrary, is at variance with a study done by Ehikhamenor (1999) who found age to have no influence on ICT cognition.

The study revealed that teachers' subject area has no significant relationship with the adoption of ICT among secondary school teachers. This disagreed with the findings of Thomas and Martz (2006) who reported that there was a considerable difference in computer literacy level of teachers based on their subject discipline. Oludipe (2004) reported that there existed a low level of acquaintances with many computer packages among science teachers in Nigeria, a deviation from the findings of this study.

Teachers' academic qualification was found not to have any statistical significance with the adoption of ICT among secondary school teachers. This finding is at variance with a research done by Roe and Broos (2005) who found that lower levels of education are shown to be associated with digital divides relating to access and use of a range of ICT. The results of this study are also incompatible with those of Rahimi and Yadollahi (2011) who found a correlation between teachers' computer literacy and academic credentials.

Regression analysis test was carried on gender, age, subject area and academic qualification as independent variables with adoption of ICT as the dependent variable. The findings showed that Adjusted R square=.076 indicating that only 7.6% of the variance in the dependent variable is explained by the independent variables. From the findings, the study revealed that age, gender, subject area and academic qualification are not the only determinants of adoption of ICT among secondary school teachers in Baringo North District. There are other factors determining adoption of ICT which may include home characteristics (family structure/composition), social/cultural perceptions, geography (rural/urban location) among others.

4.6.3 Attitudes of teachers towards adoption of ICT

The findings of the study showed that teachers had positive attitudes towards ICT. The analysis of both the positive and the negative statements showed an average mean of 4.3 on a five point scale. This high mean of 4.3 is a further confirmation of the positive attitudes that teachers portrayed. This result agreed with the findings of Al-zaidiyeen et al. (2010) on teacher attitudes towards technology which indicated that teacher' attitudes towards use of ICT are a key factor for the success of ICT adoption in schools. Lau and Sim (2008) reported that teachers can see the value of ICTs in enhancing teaching and learning, and they are positive towards further integration of technologies into classroom instruction. Teacher attitude play a big role in the integration of computers in the classroom (Bagozzi, Davis & Warshaw, 1992). The successful use and subsequent integration of ICT in education is related to and dependent upon teachers' attitudes towards ICT (Zigama, 2010).

Researchers from different parts of the world believe the use of ICT tools for educational purposes depends upon the attitudes of teachers towards technology (Albarini, 2004; Huang & Liaw, 2005; Teo, 2008). Teachers' attitudes towards ICT can determine the extent to which technologies are used in the process of teaching and learning. The attitude towards computer use is generated by an individual's salient beliefs about the consequences of continued use and his evaluation of these consequences (Al-Zaidiyen et al., 2010). Summers (1990) pointed that teachers' existing attitudes, skills and working habits will have great influence on their acceptance, style of implementation, and outcome of using computers for teaching. Further, Zhao and Frank (2003) view that new technology is accepted for use if the teacher perceives that there are personal gains to be obtained.

4.6.4 Principal's ICT leadership

The study found it useful to establish the influence of principal's ICT leadership on the adoption of ICT among secondary school teachers. The findings of the study revealed that the principals of secondary schools in Baringo North District played a major role in the adoption of ICT among secondary school teachers. Principals who led by example in adopting ICT and ensuring computer sufficiency in their schools had a higher ICT competent teachers and vice versa. This is in agreement with the findings of Khalid et al (2009) who studied the integration of ICT in Malaysian secondary schools. They found out that leadership, commitment by those involved and presence of knowledge and skills were the three conditions which when present in the school environment, facilitates the integration of ICT in teaching and learning.

Most of the principals of the sampled schools blamed insufficiency of funds on the low saturation of computers which hampered the adoption of ICT in their schools. This is in line with the findings of Oloo (2009) who found that school administrators recognized the need for incorporation of ICT in school administration and other activities but did not have adequate funding to purchase ICT equipment. All the principals from the sampled schools showed positive attitudes towards the adoption of ICT. This agreed with the findings of Serhan (2007) who studied school principals' attitudes towards use of technology in United Arab Emirates and found that the principals had positive attitudes towards the use of technology in teaching.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The study investigated the adoption of ICT among secondary school teachers in Baringo North District. This chapter uses the findings obtained from the analysis of data in chapter four to make conclusions and recommendations for possible action to be taken. The chapter is structured to cover the summary of findings, conclusions, recommendations and suggestions for further research.

The main objective of this study was to establish adoption of ICT among secondary school teachers in Baringo North District. This chapter focuses on the logical discussion of the main findings of the study as guided by the research objectives. The fundamental research objectives addressed were;

- i. To establish whether there is any significant relationship between teacher characteristics (gender, age, subject area and academic qualification) and the adoption of ICT among secondary school teachers in Baringo North District.
- ii. To investigate the attitudes of secondary school teachers towards adoption of ICT in secondary schools in Baringo North District.
- iii. To determine the influence of Principal's ICT leadership on the adoption of ICT among secondary school teachers in Baringo North District.

Five research hypotheses were explored in this study. They were;

- a) There is no significant relationship between gender and the adoption of ICT among secondary school teachers.
- b) There is no significant relationship between age and adoption of ICT among secondary school teachers.
- c) There is no significant relationship between subject area and adoption of ICT among secondary school teachers.
- d) There is no significant relationship between academic qualification and adoption of ICT among secondary school teachers.
- e) There is no significant difference between the independent variables (gender, age, subject area and academic qualification) and the adoption of ICT among secondary school teachers.

Summary of the research findings

After analyzing the quantitative and the qualitative data and testing all the hypotheses in this study with regard to the objectives of the study, it was found that majority of teachers in the sampled schools had not fully adopted ICT. Thus they were incompetent in handling ICT resources.

In order to effectively establish the relationships between the independent and dependent variables of the study, chi-square test performed at 0.05 level of significance and regression analysis were explored. The chi-square results showed that there was a significant relationship between age and adoption of ICT with younger teachers being

more competent in ICT than older teachers. No significant relationship existed between teachers' gender, subject area and academic qualification; and adoption of ICT. It therefore implies that gender (being male or female) does not influence the adoption of ICT. Teacher's subject area has no effect on the adoption of ICT. Also, it was evident from this study that the adoption of ICT by teachers was not related to academic qualification.

Multiple regression analysis was used to test the relationship between the independent variables (teachers' gender, age, subject area and academic qualification) and the adoption of ICT as a dependent variable. The findings gave Adjusted R square = .076 indicating that only 7.6% of the variance in the dependent variable is explained by the independent variables. From the findings, the study revealed that age, gender, subject area and academic qualification are not the only determinants of adoption of ICT in Baringo North District. There are other factors which may include home characteristics, cultural perceptions, geographical (rural/urban) locations among others.

Further, the study revealed that teachers had positive attitude towards adoption of ICT. The findings agreed with Lau and Sim (2008) who reported that teachers can see the value of ICTs in enhancing teaching and learning, and that they are positive towards further integration of technologies into classroom instruction. Teacher attitude play a big role in the integration of computers in the classroom (Bagozzi et al., 1992). The successful use and subsequent integration of ICT in education is related to and dependent upon teachers' attitudes towards ICT (Zigama, 2010). Teachers ascribed their positive

attitudes to the huge potential of ICT in enhancing educational outcomes as portrayed by its efficiency in achieving different tasks.

Finally, school principal's ICT leadership was found to have a significant effect on the adoption of ICT among secondary school teachers. The findings of the study revealed that the principals of secondary schools in Baringo North District played a major role in the adoption of ICT among secondary school teachers. Principals who led by example in adopting ICT and ensuring computer sufficiency in their schools had a higher ICT competent teachers while those who were not supportive lagged behind in ICT implementation.

5.3 Conclusion

Conclusions made here are based on the findings of this study that endeavored to establish the adoption of ICT among secondary school teachers.

5.3.1 Teacher characteristics and adoption of ICT

The findings of this study revealed that secondary school teachers had not fully adopted ICT in teaching and learning. It is concluded on the basis of the findings that teachers are incompetent in ICT matters. Majority of the teachers were yet to embrace ICT in their pedagogical experiences. The teachers' limited computer competence is a direct consequence of their lack of access, training, support from administrators and lack of time among others. Although adoption of ICT among secondary school teachers is a major milestone in the attainment of e-learning goals in Kenya, the lack of ICT competency could impact negatively on the efforts geared towards ICT compliancy in the education sector. From the findings of this study, it is evident that the study of teachers'

adoption of ICT is a crucial factor in teachers' acceptance and use of technology.

The survey showed that there was a significant relationship between age and adoption of ICT with younger teachers being more competent in ICT than older teachers. It was concluded that younger teachers are enthusiastic in embracing new technologies while older teachers are resistant to innovations because they want to maintain the status quo. No significant relationship existed between teachers' gender and adoption of ICT. In ICT matters and gender, a conclusion is made that gender stereotypes are wearing out with women getting equal technological exposure with men.

No significant relationship existed between teachers' subject area and adoption of ICT. On the basis of this finding, it was concluded that all subject areas are at equal footing in computer issues. The study also found no statistical relationship between teachers' academic qualification and adoption of ICT. It was evident from this study that the adoption of ICT by teachers was not related to academic qualification since teachers of Baringo North district were professionally trained, with high academic qualification most of whom are experienced in their profession. Therefore, a conclusion was made that teachers' academic qualification has no weight on the adoption of ICT.

5.3.2 Attitudes of secondary school teachers towards adoption of ICT

Findings of the study showed that Kenyan secondary school teachers had positive attitudes towards adoption of ICT with an average mean of 4.3 on a five point scale. The high means obtained in the attitude scale is a further confirmation of their positive attitude. Teachers' attitudes remained positive despite being incompetent in handling ICT

matters. It was concluded on the basis of this finding that teachers' attitudes are not influenced by lack of ICT resources since they have high regards for the great potential of ICT in education. The successful use and subsequent adoption of ICT in secondary schools is related to and dependent upon teachers' attitudes towards adoption of ICT. MOE and other stakeholders in the education sector should ride on this positive attitude in propelling ICT adoption in secondary schools.

5.3.3 Principal's ICT leadership

The qualitative data showed that school principal's ICT leadership was found to have a significant effect on the adoption of ICT among secondary school teachers. Principals who led by example in adopting ICT and ensuring computer sufficiency in their schools had a higher ICT competent teachers while those who were not supportive lagged behind in propelling ICT implementation. It was clear from the study that teachers lacked the crucial support from principals in their quest for ICT compliancy. Therefore a conclusion is made that principal's ICT leadership influences the way ICT is prioritized in school vision and mission as well as its funding; thus determining adoption of ICT among secondary school teachers.

The principals' attitudes were generally positive. They viewed technology as advancement to the classroom that would catapult learners' interest in acquiring knowledge. However, they were limited by their budgets. Schools whose principals networked with NGOs and other stakeholders were ahead in the acquisition of ICT equipment. Principals require strategies and skills in resource mobilization so that they champion ICT implementation in their schools.

5.4 Recommendations

From the results of the study, the following recommendations address the respective groups for whom the findings may be relevant;

1. Policy makers should consider making ICT a core subject in the secondary school curriculum since it is pivotal in the attainment of vision 2030. This will make education the natural platform for equipping the nation with ICT skills because schools will become hubs of ICT. It is only when ICT is made an examinable subject that MOE will allocate more funds towards the acquisition of computers in all public secondary schools. Computer access is a prelude to its successful adoption for teaching and learning. The government should provide quality ICT infrastructure to all secondary schools in order to bridge the digital divide between the 'haves' and the 'have not' in terms of ICT resources before equity issues get out of hand.
2. Since many teachers still feel anxious and uneasy about using computers in the classroom due to their incompetence in ICT matters, it is necessary that they are trained in basic ICT skills. A needs assessment study that addresses ICT inadequacies among teachers should be carried out so that a workable remedy is adapted. Provision of pre-service and in-service ICT skills in areas such as pedagogy, networking, social issues and technical matters is a prerequisite for ICT competence. This would ensure effective use of computers. Senior/older teachers require more ICT training as they portrayed higher levels of ICT incompetency. MOE should ensure that teachers receive adequate training in ICT. This measure would ensure equity is upheld in the provision of ICT services in all secondary schools in Kenya.

The attainment of vision 2030 pledges can only be visible if teachers fully adopt ICT and e-learning as a whole and pass on the benefits to their students. There is need to address the impediments to this crucial step towards ICT competence among secondary school teachers. Often teachers are not consulted before changes are introduced in education. Teachers should be involved in all the stages of ICT implementation by being given compatible technical help and training. Courses relating to various instructional technologies through KIE and other stakeholders in Kenya should be disseminated to the grassroots across the country. When training is offered, it should not merely focus on computer literacy skills popularly known as ‘computer packages’ but should present ways of adopting and integrating ICT in teaching and learning.

Successful adoption of ICT can further occur when teachers use their own initiatives to move towards ICT compliancy by acquiring laptops/personal computers and training themselves in ICT competency. Exposure trips could be organized for teachers by various schools with ICT incompetent teachers to ICT compliant schools especially the ICT centres in the district such as those equipped through ESP programme.

3. Technology is dynamic, even when teachers have been trained to handle ICT matters; there is need for continuous updates through ICT seminars, workshops and in service. MOE and other stakeholders in the education sector should ride on teachers’ positive attitude in propelling ICT adoption in secondary schools. Available in service trainings such as SMASSE should be tailored to offer courses on adoption of ICT in teaching and learning. This way, teachers will be

empowered with the latest educational technologies and thus catapult ICT uptake in the education system by imparting the technology to their students.

4. Secondary school principals should provide prudent leadership in ICT implementation. Principals on their part should keep themselves abreast with technology by not only becoming competent but by championing for ICT resources in their schools. As they lead by example, teachers will definitely emulate them. These principals should harness parents' goodwill and other stakeholders to improve ICT resources in their schools. They could also establish a professional development grant for ICT to be used in rewarding teachers who have ICT skills and are already offering services so as to motivate others to embrace technology.
5. Teacher training institutions should prepare teachers in ICT competence. These institutions should include computer skills especially the adoption of ICT in their teaching methods. The government should develop a suitable policy on the level of success in ICT proficiency to be attained by teachers in Teacher Training Colleges or universities before they are awarded certification upon completion of their training programme.

5.5 Suggestions for further research

Based on the analysis of the data and the subsequent findings, the following suggestions for further research are presented;

1. This study on the adoption of ICT among secondary school teachers was limited to Baringo North District and therefore there is need to replicate the study in other parts of the country. Such studies may consider changing the population,

sampling procedure and data collection methods utilized in the present study. Further research could include additional variables such as technical support, ICT accessibility and software availability.

2. Future studies could be conducted on adoption of ICT among secondary school principals and extended to other levels of education such as pre-school, primary, teacher training colleges and other institutions of higher learning.
3. Further research is needed to determine whether teacher characteristics such as gender, age, academic qualification and years of teaching are the best predictors of attitudes towards ICT in the Kenyan school system.

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APPENDICES

Appendix I: Introductory Letter

Moi University,
Educational Management &
Policy Studies Dep't,
P.O. Box 3900,
Eldoret.

Dear Sir/Madam,

RE: A study on the adoption of ICT among Secondary school teachers.

I am a postgraduate student at Moi University undertaking a research on the adoption of ICT among secondary school teachers in Baringo North District.

Your school has been selected to participate in this survey. The information provided will be treated with utmost confidentiality. Kindly provide honest answers. Thank you for your cooperation.

Yours faithfully,

Hosea K. Komen.

EDU/PGPN/23/09.

Appendix II: Questionnaire for Teachers

This questionnaire seeks to obtain views on the capacity of teachers to use ICT. The findings may be useful in improving the adoption of ICT in secondary schools. Kindly respond to the questionnaire objectively and the information was treated with utmost confidentiality.

Section A: Background information

Instruction-Tick all that apply in the appropriate box

1. What is your gender?
 - i) Male
 - ii) Female
2. What is your current age?
 - i) Less than 30
 - ii) 31-40
 - iii) 41-50
 - iv) Over 51
3. What is the subject area that you predominantly teach?
 - i) Languages
 - ii) Sciences
 - iii) Mathematics
 - iv) Humanities
 - v) Computer
 - vi) Tech. & applied
4. What is your highest academic qualification?
 - i) Untrained diploma teacher ()
 - ii) Untrained graduate teacher ()
 - iii) Trained diploma teacher ()
 - iv) Trained graduate teacher ()
 - v) Trained postgraduate teacher ()
 - Other.....
5. Including the current year, how many years have you been teaching?
 - i) Less than 1 year ()
 - ii) 1-5 years ()
 - iii) 5-10 years ()
 - iv) 11-20 years ()
 - v) Over 20 years ()
- 6 a). On average how many functional and / or spoilt computers are available in your school?
 - i) None ()
 - ii) Functional ()
 - iii) Spoilt ()
- b) Specify the location of the computers that you access both for personal and school use.
 - i) School computer lab. ()
 - ii) School staffroom ()
 - iii) Personal computer/laptop ()
 - iv) Commercial cyber café ()

v). Other

7. Have you ever attended any training course, workshop or seminar on using computers?

i) No () [N/B ; please proceed to section 2]

ii) Yes () please specify the number of hours and/ or days ;
..... hours days.

8. Where did you receive your computer knowledge and skills?

i) School workshop/sponsorship () ii) University/college ()

iii) Commercial computer college () iv) Other.....

9. How many years have you been using computers? years.

Section 2: Level of ICT adoption in teaching and learning

Please indicate your level of ICT use in teaching and learning (i.e both your knowledge of and your skill in using computers) regarding each of the following statements. Make sure to respond to every statement.

		Not competent	Somehow competent	Competent	Very competent
i	Operate a word processing program (e.g., ms word)				
ii	Operate a presentation program (e.g.,ms powerpoint)				
iii	Operate a spreadsheet program (e.g., ms excel)				
iv	Operate a database program (e.g., ms access)				
v	Use the internet for educational research and updates				
vi	Select and evaluate educational software for purpose of teaching and learning				
vii	Remove computer viruses				

Section 3: Attitudes towards adoption of ICT

The following statements relate to attitudes towards the adoption of ICT among secondary school teachers. Tick only one alternative for each of the statement on the Likert scale of: Strongly Agree (SA), Agree (A), Undecided (U), Disagree (D) and Strongly Disagree (SD).

Attitudes towards adoption of ICT	SA	A	U	D	SD
(a) Computers save time and effort					
(b) Learning about computers is a waste of time					
(c) Computers can enhance student's learning					
(d) Computer technology cannot improve the quality of students' learning					
(e) Using computer technology in the classroom would make the subject matter more interesting					
(f) I would avoid computers in the classroom as much as possible					
(g) Everyone can easily learn to operate a computer in the classroom					
(h) It would be hard for me to learn to use computers in teaching					
(i) I have seen some teachers use computers for educational purposes in this school					
(j) I have never seen computers being used as an educational tool in this school					
(k) Computers improve teacher's authority in the classroom					
(l) Computers would weaken the teachers' authority in the classroom					

Section 4: Principal's ICT leadership.

10. In your view, is your school principal supportive of teacher's computer use in teaching and learning? Yes/ No N/B: comment on your response.....

11. What would you suggest should be done to make technology and specifically computers have greater use and impact in secondary schools?

I would like to sincerely thank you for completing this questionnaire.

Appendix III: Principal's interview schedule

A: Give me information concerning the following (background information);

- 1 Age and subjects taught
- 2 Length of service
- 3 Length of stay in the station
- 4 Experience with computers within and outside the school

B: What is the status of computer availability and use in the school?

- 1 Number of computers {functional/spoilt}
- 2 Source of computer funding
- 3 Availability of computer lab
- 4 Availability of modern e- learning software
- 5 Use of ICT in financial management
- 6 Use of ICT in communication [school, parents, staff and board of governors]

C: How do teachers actually use computers in your school in the following areas;

(Lesson preparation, Classroom instruction, Storage purpose or In analysis of data)

D: What conditions facilitate teachers' use of computers?

(Attitudes of school management, Attitudes of teachers, ICT workshop or in-service for teachers or Technical support of a computer technician).

E: What are some of the barriers faced by your teachers in their attempt to adopt ICT in teaching and learning?

(Source of power, Computer inadequacy, Lack of time for program preparation and preview, Lack of skills to operate a computer or Computer repair and maintenance)

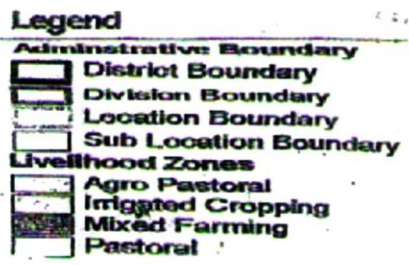
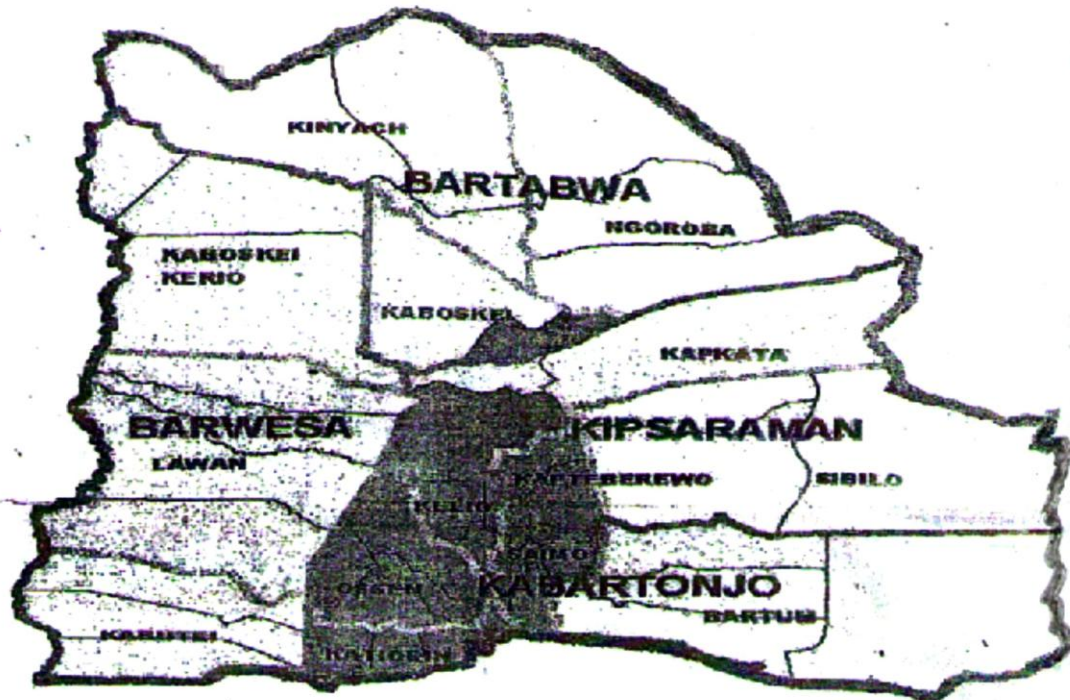
F: What are some of the formal and/ or informal mechanisms instituted to support teachers' use of computers?

G: What do you consider to be the future of computer use in teaching?

H: In your view, what should be done to enhance the use of computers in secondary schools in Kenya?

Thanks and God bless you richly.

Appendix IV: Map of the study area



Appendix V: Research authorization

REPUBLIC OF KENYA



NATIONAL COUNCIL FOR SCIENCE AND TECHNOLOGY

Telegrams: "SCIENCETECH", Nairobi
 Telephone: 254-020-241349, 2213102
 254-020-310571, 2213123.
 Fax: 254-020-2213215, 318245, 318249
 When replying please quote

P.O. Box 30623-00100
 NAIROBI-KENYA
 Website: www.ncst.go.ke

Our Ref: **NCST/RR1/12/1/INF-011/73/5**

Date:
30th November, 2011

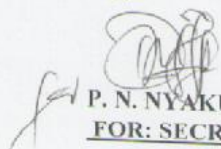
Hosea Kipyegen Komen
 Moi University
 P. O. Box 3900
 ELDORET

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on "*Adoption of Information, Communication & Technology among secondary school teachers in Baringo North District*" I am pleased to inform you that you have been authorized to undertake research **Baringo North District** for a period ending *31st March, 2012*.

You are advised to report to **the District Commissioner & the District Education Officer, Baringo North District** before embarking on the research project.

On completion of the research, you are expected to submit **one hard copy and one soft copy** of the research report/thesis to our office.


P. N. NYAKUNDI
FOR: SECRETARY/CEO

Copy to:

The District Commissioner
 Baringo North District

The District Education Officer
 Baringo North District

