INFLUENCE OF INDIVIDUAL AND CONTEXTUAL PREDICTORS ON ADOPTION OF COMPUTER TECHNOLOGY IN ECONOMIC STIMULUS SECONDARY SCHOOLS IN KENYA

BY

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DECLARATION

Declaration by the Candidate

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DEDICATION

This thesis is dedicated to my immediate family; my husband Mucheru and children Mwaura, Irungu, Nyambura and Kabura. They have been very patient with me in this journey and we can now celebrate together. Mucheru this is especially to you, for your search for new knowledge and in the process instilled in me important virtues and discipline in my search for the same.

ABSTRACT

The factors influencing technology adoption at the contextual and individual levels are interrelated. This study sought to investigate the the prediction of some of these factors at the individual and contextual levels on computer adoption in Economic Stimulus Programme (ESP) secondary schools in Kenya. The ESP was initiated by the Government of Kenya in 2009 where five secondary schools in every constituency countrywide were provided with Information Communication Technology (ICT) infrastructure to facilitate technology adoption. The objectives of this study were to: establish the extent to which computer technology was adopted; determine the extent of the individual characteristics and contextual factors in predicting adoption of computer technology; as well as determine challenges experienced in the adoption. The study was based on the ecological system theory by Bronfenbrenner (2005) and adapted a cross sectional survey design. Mixed methods approach was used in order to enrich the findings of the study. Multistage sampling was applied to select areas and subjects for data collection. Simple random sampling was used to select the schools in the clustered counties. The study targeted head teachers, teachers and learners in the ESP secondary schools as well as ICT officers in different departments of the Ministry of Education, Science and Technology (MoEST). The instruments used included unstructured interviews for the officers from the Ministry, a structured questionnaire for teachers and learners while head teachers responded to an unstructured questionnaire. Descriptive and inferential statistics were used in data analysis. In relation to adoption of computers in ESP schools, the findings showed varied levels of access by teachers and learners and only a few teachers had high competence in computer use. Frequency in usage was low. The general adoption was therefore considered low. Among significant predictors of adoption were duration of computer use, competence, administrative and technical support as well as training. Individual characteristics were found to have had a relatively larger influence in predicting adoption of computer technology in ESP schools as compared to contextual factors. Different stakeholders such as policy makers and curriculum developers will benefit from this study. Based on the findings, the study recommended that ESP schools should have ICT policy guidelines, MoEST should initiate functional monitoring and evaluation systems, the teachers' capacity that appeals to their affective dimension for ICT should be enhanced continuously. It is imperative for MoHEST to take cognizance of systemic nature of predictors of adoption, otherwise adoption will remain a distant goal in education.

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ABBREVIATIONS AND ACRONYMNS

ADEA	Association for the Development of Education in Africa
AVU	African Virtual University
BoGs	Board of Governors
CPD	Continuing Professional Development
DEO	District Education Officers
EFA	Education for All
ESP	Economic Stimulus Programme
GoK	Government of Kenya
ICT	Information Communication Technology
ISTE	International Society for Technology in Education
IT	Information Technology
KEMI	Kenya Educational Management Institute
KIE	Kenya Institute of Education
LAN	Local Area Network
LCD	Liquid Crystal Display
MDG	Millennium Development Goals
MoE	Ministry of Education
MoEST	Ministry of Education, Science and Technology
MoHEST	Ministry of Higher Education, Science and Technology
NEPAD	New Partnerships for African Development
OECD	Organisation for Economic Co-operation Development
OLPC	One Laptop Per child
TEPD	Teacher Education Professional Development
UPS	Uninterrupted Power Supply

CHAPTER ONE
INTRODUCTION TO THE STUDY

1.0 Introduction

This is the introductory chapter that discusses the background to the research problem, the statement of the problem, objectives of the study, the rationale and justification. It also has the theoretical and conceptual framework of the study.

1.1 Background to the Study

The Kenya government is committed to provision of quality education to all its citizenry. This is echoed by the different international fora and treaties to which Kenya is a signatory, such as Education for All (EFA) and the Millennium Development Goals (MDGs). The Dakar Framework for Action (2000) singled out use of Information and Communication Technology (ICT) as one of the main strategies for achieving EFA goals. One of the ways through which the government hopes to realize its aims in offering quality education and access is in the use of ICT. The third MDG, for example, emphasizes universal primary education, and the Government aims at improving quality and excellence in education. Education therefore is a natural platform for equipping this nation with ICT skills in order to support a dynamic and sustainable economic growth.

Use of technology in provision of educational products and services ensure that the learners are able to compete effectively in the global market. The government also recognizes that ICT is a key tool for transforming the economy with education playing an important role in developing necessary human resource. When learners become

technologically endowed, they become creative and innovative in ways that will make them survive economically. To this effect, the government, through the Ministry of Education, Science and Technology (MoEST), embarked on integration of ICT in education in order to increase access, relevance, quality and equity. This requires transformation of teaching and learning practices to incorporate new pedagogies appropriate for the 21st century. This commitment is accomplished through various strategies of integrating ICTs in institutions of learning.

With this regard, the Government in 2009 initiated the Economic Stimulus Programme (ESP) - ICT component to support use of technology in teaching and learning. This was a holistic programme aimed at implementation of ICT integration in education in collaboration with other stakeholders. In each constituency countrywide, five secondary schools were identified and equipped with ICT equipment and software. These have since become known as e-schools (MoE, 2010). By 2013, a total of 1680 schools had benefited from this programme. Apart from the infrastructure, the programme involved capacity building for teachers provided by specific ICT competent teachers known as ICT champions. The programme also involved provision of digital content. The main objective of this programme was to make teachers fully utilize the technology efficiently to make learning participatory, dynamic and exciting.

District Education Officers (DEOs) identified the beneficiary schools as per the set criteria of the Ministry. They were expected to oversee procurement processes to ensure that the right equipment and software were procured by the schools. Further, they were to assign the teacher trainers commonly referred to as ICT champions within the constituencies to provide first-line professional support to the beneficiary schools. The

ICT champion in each constituency was expected to train a minimum of ten teachers in each of the five schools in their constituencies. The teachers were trained and provided with ICT manuals developed by the MoEST. Heads teachers of identified schools were also taken through training by the Kenya Educational Management Institute (KEMI) on how to integrate ICT in learning (MoE, 2010).

According to the MoEST, selected schools were allocated funds to cater for a comprehensive ICT package; they were to procure 11 computers, a laptop, a printer, an LCD projector, a UPS and installation of Local Area Network (LAN) and internet connectivity for one year (MoE, 2010). Head teachers and Boards of management(BoM) were tasked to ensure security of the school ICT infrastructure procured under this programme; capacity building for staff; and that all the teachers integrated ICT in their teaching. In addition, they were to take responsibility for servicing and maintenance of the procured ICT infrastructure.

The presence of ICT infrastructure in these secondary schools has been an indication of the dynamism and technology strides being made in education by the Ministry. It also shows that education is very dynamic and keeps changing with time. Further still, teaching is based on the recognition of the dynamic needs of a technological and industrialized society. This has made it imperative for teachers to embrace technology, learn basic computer skills and effectively use the computers as tools during teaching or sourcing for information in preparation for teaching.

The decision of whether a teacher will adopt a particular technology influences the quality of teaching and learning. This has forced some level of technology adoption on

many teachers irrespective of any previous experiences, motivation or beliefs they may have in relation to the use of emerging technologies. School contextual characteristics have also been influenced by the technology age and are hence creating suitable environs, albeit slowly.

The school context such as its geographical location or environment, the population of teaching staff and students, type of learners and the leadership as well as school policies, largely determine whether or not there will be adoption of the ICT infrastructure in the school. Literature reviewed showed that adoption and use partly depends on school factors as well as individual teacher characteristics. For schools that already had ICT infrastructure, digital content and computer literate teachers, ascertaining the individual teachers' characteristics in adopting computer technology in the classroom environment in relation to school factors was important to this study. Therefore this study sought to investigate the influence of the individual teacher characteristics and contextual factors on adoption of computer technology.

1.2 Statement of the Problem

The relatively recent introduction of the computer technology into mainstream schooling in Kenya had been was envisaged to penetrate and transform teaching and learning across the curriculum. The Government's aspirations to hasten development of a knowledge-based economy spurred by innovations in information technology has made it make great strides in providing a lot of ICT resources in secondary education. Specifically, the Kenya Government has invested approximately 980 million in the Economic Stimulus Programme (ESP) for e-schools (MoE, 2012) to provide ICT infrastructure to selected secondary schools across the country. Some research studies

have been carried out on factors hindering or facilitating adoption and integration of ICT in the schools (Hennessy, Harrison and Wamakote, 2010; Kipsoi, Changach and Sang, 2012; Mumtaz, 2000). These factors are either focused on the context of the school or the individual characteristics which essentially remain key elements in adopting technology in the classroom. The research studies have however, not articulated which among these factors are more critical in the influence of adoption of technology in schools. There is inadequate data showing the systemic interaction between individual characteristics and contextual factors and which of these has a greater influence on adoption of computer technology in the classroom. This study therefore was designed to find out the significant predictors of the individual and contextual influences on adoption of computer technology in the Economic Stimulus programme (ESP) schools in Kenya.

1.3 Purpose of the study

The purpose of this study was to find out the influence of the individual and contextual predictors on adoption of computer technology in the Economic Stimulus Programme schools.

1.4 Research Objectives

The main objective of this study was to find out the influence of the individual and contextual predictors on adoption of computer technology in the ESP schools.

Specifically the study sought to:

i. Establish the extent of adoption of ICT resources in ESP schools

ii. Determine the extent to which individual characteristics predict adoption of technology in teaching and learning.

iii. Assess the extent to which contextual factors predict adoption of computer technology in the ESP schools.

iv. Establish the relative influence of the individual characteristics and contextual predictors in adoption of computer technology in ESP schools.

v. Determine the individual and contextual challenges experienced by the ESP schools in adoption of computer technology

1.5 Research questions

This study sought to find out the influence of individual and contextual predictors in adoption of computer technology in ESP schools. The main research question therefore was; to what extent does individual characteristics and school context predict the adoption of computer technology in ESP schools?

1.6 Research Hypotheses

In order to measure extent of prediction ,the following hypotheses were measured;

H01 There are no significant variables in the prediction of adoption

H02 There are no significant contextual variables in prediction of adoption

H03 There are no significant differences between individual characteristics and school context in prediction of adoption.

1.7 Justification of the Study

The eighth target of the Millennium Development Goals (MDGs) prompt governments to make available benefits of new technologies, especially ICTs to

their people. The Kenya Government has done this through its development of the national ICT policy based on the vision that ICT should be a universal tool in education and training. Education has become an essential platform for equipping the nation with ICT skills in order to create a dynamic and suitable economic growth. Consequently lots of funds, approximately Kshs. 980 million, have been spent by the MoEST in a number of secondary schools to equip them with ICT infrastructure and capacity building (MoE, 2012). The expectation is that this will translate to adoption of computers in the classroom. Since the individual characteristics and the contextual factors influence the adoption of computer technology in the school, there is need to measure extent to which they predict the different uses of computer technology in teaching ang learning in secondary schools in order to justify the worth of these investments.

This study was appropriate at that point in time because of the emphasis being given to acquisition of ICT skills in education, not only in Kenya but globally. It will also add new insights into the existing research that has been done on ICT in education in Kenya. The ESP programme may end but adoption of ICT is 'an innovation whose time has come' and therefore it cannot end but increase.

Some research studies have been carried out on factors hindering or facilitating adoption and integration of ICT in the schools (Mumtaz, 2000; Hennessy, Harrison & Wamakote, 2010; Kipsoi, Changach & Sang, 2012). Factors such as lack of equipment, software, time, competence and poor attitude are some of the most common barriers to technology adoption in education (Mumtaz, 2000; Wabuyele, 2003; Kessy, Khaemba &

Gachoka, 2006). Other factors are non-utilization of the technology, lack of administrative support, and teachers' perceptions and beliefs, among others. Such barriers have led to low adoption and usage of technology in schools (Vankatesh and Morris, 2000; Pelgrum, 2001). These factors are either focused on the context of the school or the individual teacher which essentially remain key elements in adopting technology in the classroom.

The research studies however, have not articulated which among these factors are more critical in the influence of adoption of technology in schools. There is inadequate data showing relationship between individual and contextual factors, and which of these levels has a greater influence on adoption of ICT in the school. As noted by Tang & Ang (2002), studies tend to ignore the complex systemic nature of ICT integration. This study therefore was designed to find out the influence individual and contextual predictors on adoption of computer technology in the Economic Stimulus programme (ESP) schools. In doing so, the study assesses and documents the extent of adoption of computer technology in ESP schools.

1.8 Significance of the study

This study intended to find out the influence of the individual teachers' characteristics and contextual predictors on adoption of computer technology in the Economic Stimulus Programme schools. The findings will be useful in providing policy makers at the Ministry with information on how teachers are adapting to changes which have come about as a result of using computer technology in teaching. This information will be useful for implementation of policies on computer use in the schools. Secondly, the

study will provide valuable insights to curriculum developers when emphasizing use of ICT as a curriculum delivery mode for secondary schools as well as in digitizing curriculum content. It will be a guide for stake holders with an interest in professional development of teachers in the area of ICT. Head teachers and teachers with an interest in adoption of ICT for teaching and learning will also benefit from the study as factors influencing adoption are found within the school, which is a system involving all of them. If the system functions as it should, the students are the main beneficiaries.

This study is also expected to contribute to literature for studies in ICT in education. It will add to the field of education on the influence of individual characteristics and contextual predictors for the ESP schools in Kenya. Despite distinct studies on each of these levels in secondary schools, the relationship of these levels in the ESP schools is yet to be studied. The results therefore will contribute to efforts that enable adoption of technology to achieve its maximum possible impact.

1.9 Scope

Although the use of ICT in education is very wide, the study covered adoption of computer technology in teaching and learning in secondary education level. In this study, adoption of computer technology and integration of ICT have been used synonymously to focus on the use of computers to learn basic skills, to source for information, as tools for learning and teaching and for administrative purposes. The study limited itself to head teachers, teachers and learners in public secondary schools that have been allocated ICT infrastructure under the Economic Stimulus Programme (ESP) of the Ministry of Education in the first phase of 2009. The total Number of

schools was 1020 as indicated by the list of schools from the education ministry. To gather relevant information, the study used questionnaires and interview schedule.

Within the ESP schools, the key variables that the study focused on were individual characteristics of teachers, such as competence, teaching experience, age, gender and duration of computer use. The other independent variables were the contextual factors which included administrative support, uses of ICT in school, adequacy of the ICT resources, learner motivation and training. The dependent variable was adoption of computer technology and was explained by access, usage, frequency of use and teachers attitudes.

The challenge of logistics and insecurity in North Eastern of Kenya affected the study's data collection in this region because it was not possible to reach the ESP schools within the region. Tools were however emailed to the ICT teachers in the schools.

The distance between the ESP schools in some counties proved a challenge. Data was therefore sought from the next nearest ESP school. This however did not compromise the type of data collected or the time spent in each school.

1.10 Theoretical Framework

A theoretical framework is a group of interrelated concepts that guide one's research. It is a frame of references often made from previous research to give basis or foundation that other research work is based on. This study considered various frameworks or models before identifying the most appropriate. One of the theories was Technology Acceptance Model advanced by Davies (1989) in Chen C., Li H., and Li, Y. (2011). This model widely applies to access and user's usage in Information Technology (IT)

and systems. In ICT researches, it has been an influential model to show IT acceptance to predict intention to use and acceptance by individuals. It has two determinants including perceived ease of use and perceived usefulness. Perceived usefulness is the degree to which an individual believes that using a particular information system or information technology would enhance his or her job or life performance. Perceived ease of use is the degree to which a person believes that using a particular technology would be free of effort. Although these two perceptions positively affect the attitudes toward technology and further, positively affect the individuals' intentions to use and the acceptance it, it concentrates a lot on the individual teacher in relation to the technology hence narrowing scope of this study. Technology Acceptance Model is also specific on information system usage for applying the concepts of ease of use and usefulness (Chen et al, 2011, Vankatesh and Davis 2000).

There are other technology related theories such as Theory of Reasoned Action and Theory of Planned Behavior (Fishbein and Ajzen (2010) which have the capability to explore the system usage by incorporating subjective norms and perceived behavioral controls with attitudes toward using technology. Rogers (1995) theory of adoption closely related to this research but was used mainly to explain findings.

the study's theoretical underpinning was based on the ecological system theory whose main proponent is Bronfenbrenner (1989, 2005). The critical assumptions of the theory is its description of the hierarchical nature of the environments in which individuals operate and develop, and secondly on how the different ecological contexts interact and influence each other. This theory has been identified for this study as it offers a good

underpinning for interaction between individual and technology adoption behaviors within a given environment or context. According to this theory, there are three related levels of ecology that are systemic in nature. They include micro systems, meso systems, and macro systems (Berk, 2000; Balanskat et al, as cited in Bingimlas, 2009). These authors describe micro systems as the very basic level that involves the teacher's attitude and approach to ICT. Meso level was described as the activities within the school context that involve use of ICT, while macro level was describes with reference to activities within the system that relate to wider educational frameworks.

Factors within the individuals in a school set up are equated to micro level of an ecosystem. These include teachers' knowledge of ICT such as in training and experiences, perception, pedagogical practices as well as other demographic information. The next level that the teacher operates in is the meso level. At this level the teachers' environment is the classroom. It has many aspects or 'species' interacting between the teacher and other 'species' such as learners and other resources such as books and computers. These aspects form a system that enables learning to take place. The relationship is such that a teacher's adoption of computer technology will depend not only on his or her own characteristics but on the diversity of other 'species' in the classroom. This immediate setting of an individual and reciprocating interaction in the immediate external environment in the classroom place the individual within a given period of time and development.

The larger context in the ecological model that identifies with the macro level is the school. Each school as an information ecology has its own set of practices, culture and

relationships among the various species or players. The people in the school and other non-human artifacts in the school also play a role in technology adoption (Zhao & Frank, 2003). Practices and school culture determine how and why teachers respond to ICT in the classroom (Olson, 2000). This adoption therefore is complex and systemic in nature because it includes the role of the school policies and how this links to the teacher in the micro level on a daily basis. The different levels are contexts that mediate within themselves and with each other.

The higher level in the system which is more removed from an individual involves the larger society or the government and policies at the national level. This level entails the broad educational system, the national or government policies, trends and aspirations which affects the teachers through the meso and macro systems; the classroom and school, respectively. Effects of macro system therefore cascade through influence of interactions of all other layers (Widaman, 2007). For ICT adoption, Mumtaz (2000) in Gaffney (2010) observed this by giving an analogy, that successful implementation of ICT requires three interlocking frameworks for change; the teacher, the school and the policy maker. This is a complement to the ecological theory where the three work together as a system. The perspectives that each player brings on board is crucial for this model to function effectively as a system. The ecological model of the three levels and how they interact with each other can be illustrated in concentric circles which were adapted from the frame work in Tondeur (2007b), as shown in Figure 1.

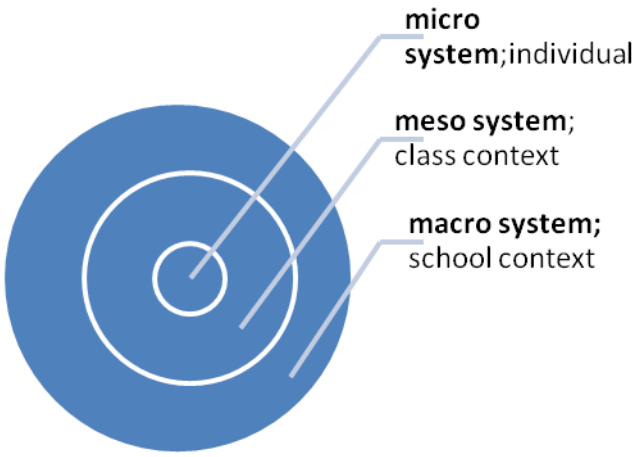


***Figure 1*: Ecological Model**

Source: Kozma, (2004)

Factors that influence technology adoption in the classroom ecology intertwine and influence each other and determine the success or failure of technology adoption in schools (Zhao, Pugh, Sheldon, and Byers, 2002).

The ecological model was used in this study to show how a set of factors act as a system that influences adoption of computer technology at different levels. The interactions among individuals such as teachers and head teachers, the technology itself and school policies can be compared to 'species' interacting within the environments or ecological levels. The interactions within the context of an ecosystem are comparable with the factors that influence the use of technology in education.

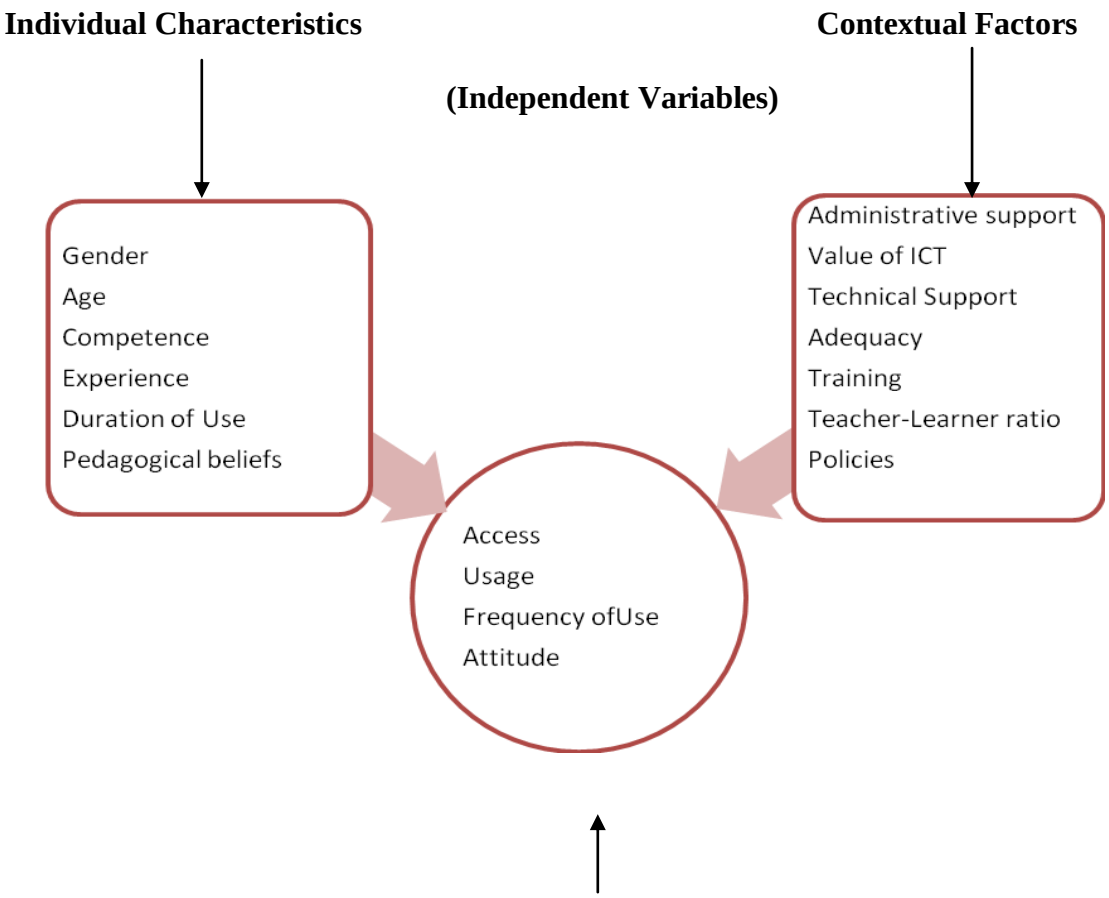
Looking across adoption theories, there is an abundance of different factors that influence whether an individual will choose to adopt a technology (Mumtaz, 2000; Hennessy et al, 2010a). The teacher's individual characteristics, the innovation itself and the school context all act together to shape the ultimate decision and persistent use of a technology by the teachers. By basing this study on the Bronfenbrenner's

ecological theory, the study suggested that though technology adoption in school is an ongoing innovation, the process does not exist in isolation but within other contexts at different levels which are interactive.

1.11 Conceptual Framework

The adoption of computer technology in secondary schools is largely dependent on how the resources are used within the school context. The teachers' individual characteristics which range from their demographic data, their perceptions of physiological closeness with students (immediacy behaviour) to their pedagogical practices; as well as the school factors as espoused by the leadership support, administrative use of ICT and how learners perceive the school context determine whether and how the technology is utilised for teaching and learning by the teachers.

The dependent variable in this study therefore was adoption of computer technology in the classroom, which was a function of the teachers' characteristics and the school contextual factors. Adoption can only be achieved by teachers who have no inhibitions in using technology and in a favorable context of supportive systems. Figure 2 presents a diagrammatic relationship between the study variables.



Source: Author, 2014

***Figure 2*: Conceptual Framework**

1.12 Operational Definition of Terms

Administrative support: financial and moral inputs as well as instructional and management leadership provided by the head teachers in the ESP schools.

Adoption of computer technology: use of the acquired ICT infrastructure for administrative and instructional purposes, sourcing for information as well as learning basic skills by teachers and learners in the ESP schools.

Computer Technology: using computers for instructional and administrative functions in the ESP schools.

Contextual factors: factors within the school environ such as teacher student ratio, policies and uses of ICT in the school, capacity building, availability and adequacy of the ICT resources.

Economic Stimulus Programme (ESP) schools: secondary schools that received ICT infrastructure under the Economic Stimulus Programme from the Government in 2009.

ICT champions: designated ICT trainers who provide capacity building for other teachers in the schools within their counties on how to integrate ICT in teaching and learning.

ICT infrastructure: resources such as computers, laptops, Uninterrupted Power Supply (UPS), projectors and internet connectivity and installlation provided by MoEST to schools under the ESP-ICT component.

Individual characteristics: attitudes and beliefs of teachers as well as their demographic information such as age, gender, experience, qualification, training and competence.

Immediacy behaviour: perceived verbal or nonverbal communication that draws learners to their teachers, such as gestures, movement and language. These motivate or puts off learners to use Computer technology in the schools.

Relative Influence: comparative effects of individual characteristics and school factors in adoption of computer technology in ESP schools.

Pedagogical practices: methods used in teaching which are inclined to either traditional or learner-centred styles of teaching.

1.13 Chapter summary

The Government of Kenya initiated an Economic Stimulus Programme (ESP) to support use of ICT in teaching and learning in selected public secondary schools in the country. This introductory chapter provided the background to this initiative where the ICT infrastructure was provided in these schools and teachers were trained to integrate technology in curriculum delivery. Administrative uses of the ICT were expected to be part of the adoption programme within the schools. Ascertaining the relative influence of individual teachers' characteristics and the contextual factors in adoption of computer technology in ESP schools was therefore the purpose of this study. The objectives and research questions related to the purpose of the study.

This study was considered appropriate because of the importance attributed to the adoption of ICT at all levels of education in Kenya as seen in the high investments. The individual characteristics and contextual predictors influence adoption. Apart from providing policy makers and other stakeholders in education with empirical information on adoption of computer technology in ESP schools, this chapter made mention of the addition of new insights into existing research that has been done on ICT in education in Kenya.

The scope of the study was in selected counties with ESP schools in Kenya. The underpinning theory of the study was the ecological system theory whose main proponent is Bronfenbrener (2005), while the conceptual framework showing the relationship of the variables was outlined within this chapter. These variables were individual characteristics and contextual factors as independent variables and adoption of computer technology as the dependent variable. The next chapter is a discussion of literature review in relation to the study.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter presents literature that was reviewed in relation to the objectives of the study. It gives a general overview of information communication technology (ICT) in education, adoption of this technology in schools, individual characteristics and contextual factors in adoption of technology, challenges experienced in adoption of computer technology as well as some empirical studies in adoption of ICT in education. The sources of the literature include published journals, books, grey literature such as reports of meeting proceedings and training manuals as well as empirical studies in the area of ICT in education.

The purpose of reviewing the literature in these areas was to look at documents that are theoretically sound, valid and reliable. This gave a theoretical base for this research and review what had been done in order to identify gaps in relation to this research. Review of literature also helped in identifying aspects that have received inadequate focus in adoption of ICT in schools in order to give context to the current study.

2.1 Concept of ICT

Information and Communication Technology (ICT) has the potential to play a powerful and significant role in access, equity, relevance and inclusiveness in education (Scheuermann and Pedro, 2009). Information Communication Technologies (ICTs) for teaching and learning are technological tools in form of hardware and software that help communicate, develop, disseminate, store and manage information. The technologies

include computers, the internet, broadcasting technologies (radio and television), and (mobile) telephony which can be in form of hardware (such as computers, digital cameras), software (such as Excel, discussion forums), or both. Computers, laptops, internet, television and mobile phones are some of the ICT tools used in education to enhance the teaching and learning process (MoE, 2013).

ICT plays a crucial role as learning resources and improving the environment for learning. It helps in preparing students to acquire skills, competencies and social skills that are fundamental for competing in the emerging global "knowledge" economy (National ICT Strategy, 2006). Its benefits in education include enhanced understanding of complex and abstract concepts, enhanced performance in education out comes, increased access to information and training and facilitating development of essential skills for knowledge based work if embedded within the learning context. Kozma, 2008 (in Scheuermann and Pedro, 2009) outlines important reasons for countries investing in ICT in education that include; "to advance education reform such as major curriculum revisions, shifts in pedagogy or assessment changes and to support educational management and accountability, with an emphasis on computer based testing and use digital data and management system." (p. 14).

The impact of ICT on the education goals include rapid expansion of knowledge, improved examination outcomes, enhanced communication and technical efficiency, as well as greater decentralization in the delivery of education services. The tremendous potential of ICT especially in the development of knowledge societies has made it very attractive and hence many countries globally have implemented ICT integration in

education initiatives to varying degrees of success. Some countries such as Rwanda and Ethiopia in Africa, Peru and Uruguay in South America, and Portugal and Macedonia in Europe, among others, have implemented the 1:1 laptop project (OLPC News, 2009). This means that for every child in the school, there is a lap top.

The inspirations that have led to the introduction of technology in education include, and not limited to, bridging the digital illiteracy, promoting the quality of education and ICT literacy for students and teachers, promoting 21st century skills. These are important in the development of highly qualified human capital for participation in the global economy, local economic development and business growth and promoting ICT as an essential learning skill.

It is now globally accepted that quality education should provide 21st century skills. These have been outlined by Intel (2008) to include learning and innovation skills (Creativity and Innovation, Critical Thinking and Problem-solving, Collaboration and Communication); Information, Media and Technology skills (Information Literacy, Social Responsibility and ICT Literacy skills); and Life and Career skills (Flexibility and Adaptability, Initiative and self drive, Social and Cross cutting skills, Productivity and Accountability, and Leadership and Responsibility). These skills have led to creation of 21st Century classroom environment where teachers and learners have the ability to use both virtual and real space simultaneously and interchangeably. The 21st Century classroom is a technology enabled environment where learners continuously engage each other as well as their teachers as they learn (Tacket, 2011).

According to policy documentation such as the Sessional Paper No.1 of 2005, the National ICT Strategy for Education and Training, the Kenya Vision 2030 and the Sessional Paper No 14 of 2012, the Kenyan government has made education one of the major platforms of equipping the nation with ICT skills for dynamic and sustainable economic growth (Republic of Kenya, 2005; MoE, 2006; Republic of Kenya, 2007; Republic of Kenya, 2013). In particular, the Sessional Papers recognized that ICT brings many benefits to the classroom as well as offering opportunities for learner-centred learning. The Vision 2030 has, among other strategies, mentioned intent to establish a computer supply programme that will equip students with modern ICT skills (Republic of Kenya, 2007). These efforts at the policy level must be cascaded and actualized at school level and specifically at classroom level in order for technology adoption to be effective in enhancing learner understanding and making learning more meaningful (Mahmud & Ismail, 2008).

In Sessional paper No.14 of 2012, education in Kenya is in the process of being transformed to meet the 21st Century needs for education and training in cognizance of the requirements of the Vision 2030 and to attain educational goals (Republic of Kenya, 2012). This policy document underscores the commitment of the Ministry of Education to competency based teaching and learning that promotes learners to actively engage in their learning. This type of education and training focuses on learners actively acquiring knowledge, skills and attitude that will enable them to be prepared for 21st century labour market. It is envisaged through this policy that the incorporation and provisions of ICT in education will enhance the quality of education, broaden access and provide the youth with skills required in the emerging economy. Although this may seem too

ambitious for the education sector, ICT in education is an innovation whose time has come.

2.1.1. ICT in Education in Africa

In Africa, the process of adoption and diffusion of ICT in education is transiting from experimental and donor funded projects to systematic integration guided by National ICT policies. The programmes of implementation however vary from one African country to another. There is faster progress in North African countries due to their higher bandwidth to Europe, and in countries with stable economies which place high priority in ICT applications (Farrell, Glen and Isaacs, 2007). Public and Private Partnerships (PPP) have been the main driving force in ICT in education in Africa. These have involved government ministries, education institutions, and donor and development agencies, or civil society organizations who have teamed up to garner resources and prioritized ICT education projects.

Although research surveys in the recent past and mid 2000s indicated a low profile on ICT infrastructure in the education system, emergence of government policies, frameworks evolution of networks and the growing commitment in among African leaders and Ministers of Education in Africa is transforming the situation. There are however general challenges such as lack of infrastructure, affordable connectivity and unreliable supply of electricity that have continued to constrain full adoption of ICT in education and pedagogical processes in Africa (Farrell, Glen and Isaacs, 2007). This has slowed down the process of reengineering use of technology as a resource in education.

However, the use of computers in schools and establishments of school networks is ongoing in many African countries. Although the common practice is equipping schools

with computers for teaching basic skills and computer packages, ICTs in Education have many activities that range from high-level intergovernmental, multi-stakeholder programmes, such as the New Partnership for Africa's Development (NEPAD) e-Schools initiative, to institutions focused on networking African schools and universities such as the African Virtual University (AVU), to collaborative learning projects that directly involve learners and teachers from some schools in selected African countries.

Prominent organizations have actively supported ICT in education. They include the African Development Bank (AfDB), Association for the Development of Education in Africa (ADEA), Cisco Systems, Intel and UNESCO, among others. These efforts have supported the use of ICTs in education in Africa by assisting with open, distance, and e-learning capacity development, producing research and guide books on the use of ICTs in education, and partnering in the e-Schools programmes by contributing human and financial resources. These organizations support the creation of 21st century skills.

In the region, the East African Community countries have formulated national ICT policies (Hennesy, Onguko, Harrison, Angondi, Nassem and Wamakote, 2010). In these policies for education, the East African countries express the need for integrating ICT in both formal and informal education. Most of them have drawn out plans for ICT integration in their schools. They have made commitments to invest in ICT infrastructure in schools with deliberate plans to ensure that the digital divide between rural (poor) and urban (rich) schools does not escalate and that children with special needs are catered for as well. Public and Private Partnerships (PPP) have been exploited to advance ICT initiatives in schools. Notable among these partnerships are SchoolNet,

One Laptop per Child (OLPC), NEPAD e-schools initiative, the Microsoft Partners in Learning Program, and Connect-ED, among others. In particular, the OLPC launched in 2000was very ambitious and sought to ensure low cost robust laptops could be affordable by all pupils in the developing countries (Kavagi, 2010).

2.1.2 ICT in Education in Kenya

In Kenya, ICT integration in the education sector has been defined as the seamless integration of ICTs in teaching, learning and management across all levels of education (MoEST, 2013). The vision of the Ministry of Education, Science and Training (MoEST) is to facilitate ICT as a universal tool for education and training. In order to achieve this vision, every educational institution, teacher, learner and the respective community should be able to access appropriate ICT infrastructure and be equipped with competencies for use. The Ministry recognizes the fact that ICT provides capabilities and skills needed for a knowledge-based economy as well as transforming teaching and learning to incorporate new pedagogies that are appropriate for the 21st century. The Cabinet Secretary in the MoEST has keenly been articulating issues in ICT integration in education by saying that this (ICT) is a key driver to achieving the country's long term development plans and has therefore to be integrated in the education system (Masese, 2013).

The Ministry of Education has been facilitating effective adoption of ICT use to improve teaching and learning as well in administration for delivery of education programmes and services. The ICT strategy of the Ministry is to have schools equipped with ICT facilities and capacity building in order to promote teaching and learning. The current Government's proposal to provide primary schools with laptops attests to this.

Provision of ICT resources in secondary level had been done in the ESP schools. It is expected that from an early grade, learners will be equipped with the necessary 21st century skills through integration of ICT in teaching and learning.

The National ICT policy lays emphasis on promotion of ICT in education at all levels. It underscores the Government's commitment to promote the use of ICT in achieving social and economic transformation. The policy outlines strategies that promote ICT in education at primary, secondary, tertiary and community levels by developing ICT curricula and ensuring that teachers possess the requisite skills; Supporting locally based development of IT applications and multimedia content for productivity; Promoting the development of e-learning resources; and Facilitating Public-Private Partnerships to mobilize resources in order to support e-learning initiatives (Republic of Kenya, 2006)

Other legislations in the education sector such as the Education Act (2012) and TSC Act (2012) have prioritized the use of modern tools in improving the delivery of quality education and training at all levels. This coupled with the country's aspirations to become a middle-income economy by the Vision 2030 calls for review of practices and tools used in order to prepare learners and facilitators for this change. The National Education Sector Support Programme (NESSP, 2013-2018) take cognizance of the need to expose teachers to contemporary and relevant experiences in using modern methods and media in curriculum delivery. According to the social pillar of the Vision 2030, one of the strategies for education is a computer supply programme that will equip students with modern ICT skills (Republic of Kenya, 2007). Through this pillar, the MoEST is obligated to provide quality education that prepares learners to competitively function

within a highly integrated, technologically-oriented and information-based global economy. In so doing, the Vision envisages modifying education and training curriculum in this country to ensure that creation, adoption, adaptation and usage of knowledge becomes part of formal instruction (Kinuthia, 2008).

Apart from the NEPAD e-schools, the PPP in Kenya have seen developments of ICT both in infrastructure and capacity building. Another example of such partnerships includes Computers for Schools Kenya (CfSK). This is a partnership of communities, private sector corporations, civil society organizations, international charities and development partners which have been working together for ICT in education in Kenya.

This institution has been in existence in the last ten years in Kenya, and has sourced over 100,000 personal computers that have been deployed in over 7,000 Public Secondary and Primary Schools, Technical Training Institutes, Teacher Training Colleges, Medical Training Centres and several Universities (CfSK, 2013).

Apart from infrastructure, CfSK has also carried out training to over 20,000 heads of schools and teachers, among others. They have also developed digital multimedia teaching/learning resources specifically intended for the national Secondary School curriculum – providing both teachers and students with an invaluable modern tool that makes learning fun and stimulating. This close partnership boasts of an estimated 3,000,000 young Kenyans who now have access to ICTs that they would have otherwise not accessed.

Some researches in technology in education have indicated that many teachers in our schools resist introduction of ICT, partly because of the dynamic nature of technology.

The pace of changes in technology relating to teaching and learning may be too fast for some teachers; more so those who feel they have been achieving their targets without it. Despite this, the computer technology use for schools is a major initiative in Kenya's educational system. Fullan (2005) and Rogers (2005) posit that teachers do not simply assimilate new changes such as new curriculum, or innovations. In his earlier edition (2001), Fullan goes on to explain that change or innovation takes teachers out of their comfort zones thus creating anxiety and uncertainty, while Rogers states that individuals adopt to change depending on whether they value the new approach when compared to the existing one. Teachers must be made to understand why they need to change, and how the innovations will benefit the teaching and learning experience. However, Ogula (2013) observed that use of computers is a new innovation which must reflectively be done to make the teacher teach and pupils learn more effectively than before. Such innovations promote better knowledge and understanding of lesson objectives, as long as teachers are convinced that they can be used to improve their performance as well as that of their learners.

2.2 Adoption of Computer Technology in Schools

The concept of technology literacy is increasingly becoming integrated into mandated curricula (Barron, Kemker, Harmes and Kalaydijian, 2003). This has forced some level of technology adoption on many schools and teachers. Although decisions about integration of technology are frequently made at higher levels, such as national level, it is the individuals' adoption patterns that illustrate a successful implementation. Barron et al (2003) have further verified teacher technology use has increased in classroom in the United States due to increased levels of access and skills and the favorable policy

environment. This is a reflection of Kenya's ESP schools which are currently favored by provision of ICT resources, capacity building and strong national ICT policies. The question that seeks an answer is how these resources are used in the ESP schools and by whom?

In the process of adoption of technology, it is possible to find one individual teacher who chooses to adopt a technology while another resists, or the social and school context may influence the individual teacher's decision to adopt technology (Straub, 2009). The decision of whether a teacher will adopt a particular technology influences or affects the quality of teaching and learning. Ertmer (2005) is convinced that, "the decision whether and how to use technology in the classroom rests on the teachers, whose beliefs about teaching and learning and technology needs to be examined" (p.7). This study while agreeing with this proposition, adds that the school context is crucial in determining the adoption of technology in the classroom by teachers.

Adoption of computers in schools is understood in advent of ICT as behavior change among its teachers, students and the school administration. Whereas the results of adoption are measured in terms of behavioral change, the predictors of that behavioral change can be understood through contextual, cognitive and affective factors (Straub, 2009). Although adoption does not equal acceptance, adoption may not easily be isolated from acceptance. It is when a technology is accepted that it can lead to its adoption. Acceptance of ICT in secondary schools is gaining mileage in Kenya, albeit slowly, and this makes it imperative to establish how this has been translated to adoption in the ESP schools.

Use of computers has increasingly attracted educators due to the rapid development of emerging technology and innovations. In its endeavor to match the digital age, the Ministry of Education has established digital learning in schools to boost quality and access in education (MoE, 2012). Digitization of content is currently a dominant trend in this age of globalization which will enhance the provision of electronic instructional materials and improved pedagogies. Use of emerging ICTs like the computer elicits two types of learning; first, learning that takes place 'from them' like developing basic skill, and secondly, learning 'with them', where it is a tool to guide the learning process and as a resource to help develop higher order thinking, creativity and research skills (Hennesey et al, 2010b). Different literature has attempted to explain adoption of ICT by giving different types of educational computer uses. Ainley, Banks and Fleming, (2002) for example outline different computer uses such as computer as information resource tools and computers as authoring tools. O 'Dwyer, Russel and Bebell (2004), and Kent and Facer (2004) explain the use in terms of adoption of specific software applications. Tondeur, van Braak & Valcke (2007a) clearly categorized actual computer use for schools into a three factor structure; basic computer skills, computer as information tools and computers as learning tools or instructional use. The three factors by Tondeur, et al. (2007a) have been used in this study in relation to individual and school characteristics. The basic computer skills are either learnt by teachers or students. Computers as information tools is explained by their ability to source and store information and computers as instructional tools is seen in their ability to deliver the curriculum content.

Adapting to the digital age is a new challenge for teachers, especially those who have a long teaching experience and mainly use conventional methods of teaching. Leaving the traditional mode of teaching and embracing new technology in pedagogy is a challenge that older and more experienced teachers prefer not to deal with. It is also a daunting task to transform traditional pedagogy where the teacher is the source of information to constructivists' environments that are more learner-centred. In many traditionally taught classrooms such as those in Kenyan schools, the emphasis is on learning large amounts of content at a rapid pace so as to cover the syllabus in preparation for national examinations (KIE, 2010). This may make integration of ICT an uphill task in many learning situations as teachers may tend to consider adoption of technology as an intrusion rather than a tool to enhance teaching and learning.

The 21st century skills require that teachers teach differently from the traditional teacher centred approach. The shift to a more learner centred approach is based on technology as the aid. Since proliferation of ICT in the classroom is inevitable, the role of the teacher must change. Teachers and text books are not the only sources of information to the learners anymore, as it has become necessary for them to encourage critical thinking, promote information literacy and nurture collaborative working practices. These can be facilitated by using ICT in teaching, hence training of teachers in ICT use becomes crucial (Gachoka, 2011). There has been a series of training in ICT integration by different partners in education for the teachers both in primary and secondary schools. Those in ESP secondary schools received training mostly from ICT champions within their counties when the program began. The ICT champions were

identified for this purpose by the Ministry of Education through the offices of education in the Districts.

The exposure of the learners to technology rich environments require teachers to acquire IT skills in order to cater for learning in the 21st century. The International Society for Technology in Education (ISTE) emphasizes that for this to happen, and for learners to have vastly increased opportunities to become technologically proficient members of this technological age, they should be educated by teachers who have competently adopted technology (ISTE 2002, in Nicolle 2005). They should also be able to access the ICTs within the school and use them frequently. Access has been found by various researches (Bingimlas, 2009; Mumtaz, 2000) as a factor that influences ICT use in the classroom. Kavagi (2010) too observed that the way computers are stored and accessed directly determines how much they will be used.

It has been argued that learners are becoming more adept at using technology than their teachers (Moyle, 2010). Student attitudes, concerns and experience with technology in general and as an instructional tool are important determinants in the successful take-up of digital content by teachers (Mishra and Koehler, 2006; Groff and Mouza, 2008). This is as a result of quick access information through emerging technologies which are readily available to them at home and in the community. In this regard, the role of learners too is shifting from passive recipients of information that is reproduced during examinations. Due to the exposure, learners can be active participants in the learning process producing knowledge and learning collaborations (Gacoka, 2011). Ironically, it is the teachers' responsibility to prepare suitable environments and avail opportunities that facilitate learners' use of technology. In essence, they must possess relevant skills

in computer operation, knowledge in integration strategies and create time for adaptation of innovations in the school curriculum. Teachers may not have an alternative but change with the times, especially in the contemporary scenario where technology is being introduced in a larger scale at the primary school level countrywide. As far as teachers are concerned therefore, adoption can be attributed to various characteristics among them as individuals; a fact which may influence their perception of computer technology.

2.3 Teacher Characteristics in Adoption of Computer Technology

Teachers are at the center of curriculum implementation and they control the teaching and learning process. In any educational reforms, the teacher is a crucial element. Qualified teachers are often seen as a catalyst in the introduction and effective use of technology in schools. Unfortunately, in Kenya, like in many African countries, lack of adequate ICT trained teachers and the low levels of teachers' ICT knowledge and skills have been identified as major impediments to effectively introducing technology into schools (Kavagi, 2010). Many school leaders perceive the lack of ICT-related knowledge of teachers as one of the main impediments to the realization of their ICT-related goals (Pelgrum, 2001). Competencies that each teacher needs to acquire depend a lot on the specific circumstances of their particular school. In Nigeria for example, teachers' lack of expertise in using ICT is a prominent factor hindering teachers' readiness and confidence of using ICT during lessons (Tella, Toyobo, Adika, and Adeyinka, 2007). Having ICT-literate and confident teachers is clearly a prerequisite for adoption of any form of ICT into schooling. Until recently, training opportunities have remained limited and inconsistent in quality; and teachers' ICT proficiency and

knowledge of the potential of ICT for supporting teaching and learning have thus remained limited.

Levels of teachers' own education and literacy rates and access to professional development play an important role in teachers' adoption of technology in the classroom. JISC (2004) in their study on developing maturity in learning technology reveal that the most significant barriers identified are linked to staff attitude and training in the use of ICT, access and ICT skill in general. When technology is introduced to practicing teachers, they have to be trained on how to adopt it; hence for them it may be a new innovation. For teachers as adult learners, the theory of andragogy applies to them. This is a learning theory directed to adult learners (Knowles, Holton and Swanson, 2005). According to Kowles et al., methods of directing adult learners are self directed, experiential and approach to learning as a problem solving activity. It is done within a learners understanding of 'why'. In addition, they learn best when the issue at hand is of immediate value and relevance. These assumptions of the andragogy theory should complement any In -service Training (INSET) of the Ministry of Education when capacity building teachers for the adoption of technology in ESP schools. Training them without considering theories that underpin adult learning such as the afore mentioned may compromise effectiveness and quality of the INSET.

Teachers' individual characteristics which include demographic information like level of educational, age, gender, experience and training and competence in use of the computer can influence the adoption of an innovation (Schiller, 2003). Specifically, attitudes of teachers indicate a gross lack of independent learning skills and a reluctance

to take responsibility for their own learning. Attitudes indicate whether a person likes or dislikes using something. Van Braak et al. (2004) postulate that teachers with a positive attitude are more likely to use computers in the class. Consequently teachers' expertise and lack of knowledge to evaluate the use and role of ICT in teaching are prominent factors hindering teacher's readiness and confidence in using ICT support. Moreover, there is a dearth of qualified IT professionals who might work with teachers on ICT-related matters and this is exacerbate by the problem of 'brain drain,' leading the experts to opt for better paying jobs elsewhere (Alemneh and Hastings, 2006). The psychological factors of the teacher's own beliefs and attitudes to ICT and pedagogic innovation therefore are identified as the primary facilitators and barriers to teacher use of ICT in the classroom (Hennessy and Onguko, 2009).

The adoption diffusion theory of Rogers (1995) describes teachers' attitude and competence with technology being among key factors associated with their adoption. A competent teacher should be able to operate computers and use basic software for word processing, spreadsheets, and email among others. Such a teacher should also be able to evaluate and use computers and relate ICT tools for instruction and apply instructional principles and appropriate practices to the use of ICT (Gachoka, 2012). Other key factors associated with adoption include the teachers' pedagogical beliefs (Mishra and Koehler, 2006) and perceptions. The teachers' pedagogical beliefs relate to the specific use of computers in the classroom as it influences the extent of their adoption of ICT.

Pedagogy is focused on the effective learning of subjects with the support of the various components of ICT. In many instances low level of computer use has been associated

with teacher centred or traditional classrooms (Ertmer, 2005). Teachers in such classrooms are less likely to bother with adoption of computers at all. Olakulehin (2007) emphasizes that the pedagogic application of ICT involves effective learning with the aid of computers and other information technologies as learning aids, which play complementary roles in the classroom, rather than supplementing the teacher. Teachers are not always fully aware that pedagogic uses of the computer require the development, among teachers as well as students, of new skills and attitudes for the effective use of ICT. Rogers (1995) observed that teachers' reluctance to abandon their existing pedagogy was more of an obstacle to teacher development in classroom. It has much to do with the personal beliefs, attitudes and interests. Nicolle (2005) noted several barriers of non adopters, among them, judging technology as being ineffective in substituting traditional instruction, as increasing workload and teachers' reluctance to assume role of a student. Such apprehension among teachers may compromise their rate of technology adoption. Moreover, when the government or development partners provide new technology equipment in schools, it is likely to remain idle or used poorly unless teachers are cognizant about what they can do with it, and a short induction from its supplier is far from adequate to realize pedagogical potential (Henessy and Onguko, 2009). This is also inadequate in enhancing their competence.

Additionally, teachers' adoption of computer technology will often also depend on degree to which technology complements his or her teaching style (Zhao and Frank, 2003). In this context, teachers' perceptions of the technology as an innovation strongly influence the process of implementation (Fullan, 2001). This means that the personal willingness of teachers to adopt and integrate innovations into their classroom practice

is of crucial importance for the innovation to be successful (Gess-Newsome, Southerland, Johnston and Woodbury, 2003; Nicolle, 2005). Indeed, understanding teachers' perceptions is also important for the successful implementation of ICT in education (Groff and Mouza, 2008). This makes it necessary for any efforts to enhance capacity of teachers in ICT adoption to help teachers relate what they normally teach with what the innovation can do. Whatever strategy is adapted to enhance teachers' capacity, there is need to build a critical mass needed to implement a paradigm shift in adoption of technology (Nicolle, 2005).

Time is often cited as a challenge by teachers who hope to adopt technology in teaching. Marshall, Elgort and Mitchell (2003) indicated that teachers continue to identify lack of time as a barrier to the use of technology. While some interpret this to mean that staff has not had the time to acquire the necessary skills in the use of technology in teaching, lack of time to get to grips with new technologies is an obstacle linked to the increasing lack of qualified teachers (KIE, 2010).

Other characteristics that individual teachers possess which influence adoption of technology have to do with their own personality. They include their gender, age, experience in teaching and even their educational background. Depending on topical areas under study, these may or may not be significant in explaining differences in technology adoption. Kotrlik and Redmann (2009) in an earlier study (2000) found out that gender did not explain any variance in value placed on IT of teachers. Gender difference in ICT use may therefore vary and often depends on subject under discussion. Kotrlik and Redmann (2009) considered gender as one of the teacher characteristics that may influence adoption. The teachers' age and experiences are other

constructs that they examined. Waugh (2004) concluded that adoption of technology decreased as age increased, while on the same note, Mumtaz (2000) postulated that lack of teaching experience with technology was a factor that resulted in teachers avoiding use of technology. Kotrlik and Redmann further indicated that more experienced teachers are less likely to utilize technology than less experienced teachers.

2.3.1 Teacher Immediacy Behavior and Learner Motivation

The behavior patterns of teachers affect the behavior patterns of students in learning skills (Smith 1979, in Christophel, 1990). Learners' interest and motivation when being taught to use computer technology depends on 'how' they are taught rather than 'what' they are taught. Christophel, (1990) describes teacher immediacy as the degree to which perceived physical and/or physiological closeness of teachers affect their learners. Immediacy is a construct based on the approach-avoidance theory advanced by Mehrabian (1967). He defined teacher immediacy as those verbal and non verbal teacher characteristics that generate perceptions of physiological closeness with students. Unknown to teachers, their verbal and non-verbal communication behaviors is a potential predictor of instructional effectiveness during ICT lessons. Besides computer or digital literacy, teachers' behavior in use of ICT can kindle interest in students in learning and having a positive attitude towards information technology as a learning tool. There is evidence that ICT use can make a positive contribution to motivation and learning by students (Ogula, 2013). One can therefore deduce that a teacher's enthusiasm and expressiveness during lessons when using ICT can influence a learner's motivation. Immediacy behavior in a classroom is about how the teacher communicates. Teachers' salient behaviors such as their vocal expressiveness about the technology,

their facial expressions or gestures when handling the innovation while teaching and the body position have a direct correlation and association with learners attention, enhanced memory and recall (Christophel, 1990; Kelly and Gorham, 1998). Hence the teachers' behaviors in the process of teaching will either draw the learners towards or away from an innovation in the classroom, in this case the use of computer technology.

Teacher immediacy behavior may contribute to levels of learning and influence students' motivation. Integration of ICT in learning has been known to motivate learners and they will tend to be drawn towards the technology and gather interest in the classroom teaching at the micro level. Using ICT is also perceived as having the advantage of heightening motivation for the learner; helping recall previous learning; providing new instructional stimuli; activating the learner's response; providing systematic and steady feedback; facilitating appropriate practice; sequencing learning appropriately; and providing a viable source of information for enhanced learning.

Use of computer technology as an innovation for teachers means that they would have to redefine their role in the learning process by stimulating students to work and learn in self-sustained, responsible and autonomous ways. ICT makes the lessons more interesting, easier, more diverse, motivating and more enjoyable for the pupils. In as much as promoting ICT use in the classroom enhances learner motivation, they are likely to become undisciplined and create disruptive behaviors with the technology (MoE, 2013). Furthermore, teachers who are still learning to use technology may not find it easy to adopt it for instructional use despite its advantages in motivating learners. Brinkerhoff (2006) said that such transition is a process, not an event: "transitioning

teachers from novice technology users to effective technology integrators capable of supporting student learning generally takes three to five years" (p. 38).

Previous experience of secondary school teachers in using computers before the ESP was initiated, as well as their competence which was considered necessary if adoption of computer technology was to be effective, both in instruction and as a support to teaching and learning. Student attitudes, concerns and experience with technology in general and as an instructional tool are important determinants in the successful take-up of digital content by teachers (Mishra and Koehler, 2006; Groff and Mouza, 2008). Moyle (2010) provides insights into how students use technologies for learning, and communicating with inside and outside of school, and reflects upon the implications of these practices for students and schools. There is much that educators do not know about how students use technologies. In noting that emerging technologies, such as Web 2.0 social networking, provide new opportunities, Moyle (2010) advises that the "Ubiquity of technologies and the robustness of young people's abilities to communicate and collaborate presents challenges for educators and stakeholders about how they conceive schools" (p. 39). The Web 2.0 social network tools are web based soft ware tools that enable users to contribute easily to the internet and communicate with others (MoE, 2013). They enhance collaboration, creativity and information sharing. If well used, they can transform teaching and learning experiences.

2.4 Contextual factors and Adoption of Computer Technology

The school environment greatly influences the manner in which different forms of technology are used. Factors such as electricity, appropriate infrastructures or resources and equipment, technical and administrative support create an enabling environment for

computer adoption. However, the introduction of computers in the schools was according to Hodas, (1993, in Papert 1999) a 'foreign body' that threatened the established order of the system. He called it; "…undesired and disruptive; if it means that culture must change its values and habits in order to implement it" (p. 2).

These views show that computer technology which in the last decade started penetrating schools' set up call for serious changes in the curriculum, ways of teaching and school structures. It requires change in status quo and this is not easy as change is often not easily welcome. When existing structures and practices are threatened by incoming changes, the schools naturally and necessarily will resist change (Cuban,2001). This probably explains why schools have been slow in adapting to ICT educational reforms. Means (1994) posit that the structure of the school can severely hamper the power of new technologies for learning and teaching.

In the day-to-day life of schools, impeding factors such as the abdication of leadership by school executive, the overt control of the infrastructure by the IT teachers, and constraints on teachers' time to learn and engage with the technology brought about by pressures to cover the curriculum and teach for the examinations (Lee and Gaffney, 2008) are counterproductive. On the other hand, whole-school valuing of digital technologies and associated ICT resources, especially by the school leadership, makes a difference.

While head teachers are important agents of change as school leaders, negative attitudes among school leaders and Board of Governors towards computers and internet obstruct prioritization of ICT integration. In order to address the multi-faceted challenges that

threaten computer adoption in the school leadership, schools need to develop capacity of their leaders to guide effective and more holistic integration of ICT. This is because the school leadership is in a position to create an enabling environment to advance use of computer technology in their schools (Dawson and Rake, 2003).

ICT policy plans at the school level are described as school-based ICT policies (Jones, 2004). Compared to policies situated at the higher levels, that is nation or county level, school-based ICT policy plans are mostly linked with classroom activities and can benefit student learning. This reflects a relationship between school policies and ICT changes in the classroom (Baylor and Ritchie, 2002). The conditions of the school informal policies, capacity to innovate by availing infrastructure, its contextual characteristics and whether the leadership nurtures a technological culture further determines if a school adopts to ICT use (Mumtaz, 2002; Pelgrum, 2001). Dawson and Rake (2003) observed that as much as teachers may be willing to adopt ICT for teaching, it may not happen if the school leadership or head teacher is not computer literate. If the school policy therefore is more established, it is possible that the classroom use of ICT will be significant, and ensure literacy of all including the head teacher as the instructional leader. However, Tondeur et al. (2007a) indicates that ICT integration is not achieved in a systematic way in most school because school policies are often underutilized.

The OECD report (Venezky and Davis, 2002) highlights roles that Government and Ministries of Education play in supporting take up of technology in schools. The schools are encouraged to have their own strategies and policies embedded within their school motto. This calls for concerted efforts from the leadership levels at the Ministry

of Education both at the national and county levels to ensure effective programme delivery and functionality of the infrastructure. This system of operation is supported very well by the ecological systems theory.

With the introduction of Computer Studies in schools in 1996, the subject became optional and teaching it is "about the computer rather than with the computer" (Kavagi, 2010, p.96). This has not only made it difficult for teachers to integrate this potentially versatile tool in their work, but within schools, students have different levels of access to computers based on the subjects they opt for (Kavagi, 2010). Only students taking Computer Studies as an examinable subject have regular access to the computer room. Access to ICT facilities therefore varies with schools, teachers and students. For instance, a study by Ndidde et al. (2009) showed variations in ICT use for learning by students, which he observed depend on access to computers, institutional rules and regulations and the level of ICT skills by the learners. Specific culture of a particular school, its environment and uptake of technology determine competencies that teacher acquire. The successes or failure of any educational technology is influenced by school culture.

At the macro or national level, the ICT policy plan acts as a blueprint for the sequence of events a school hopes to achieve. The content of the ICT policy plan refers to the school's expectations, goals, and actions concerning the integration of ICT in education. This includes elements such as vision building, professional development, ICT curricula, and ICT planning and evaluation (Van Braak et al., 2004). Consequently, an ICT policy plan is not only about hardware and internet connections, but particularly how learning institutions will get involved and implement the plan by adopting

technology. Baylor and Ritchie (2002) have observed that schools which are successful in adoption of ICT are often guided by an ICT internal and operational plan. Similarly, Tondeur et al. (2008) found that teachers in schools with an explicit ICT policy plan that emphasizes shared goals tend to use ICT more regularly in their classrooms.

What seems to be lacking in the schools under ESP is a monitoring system from the macro level down to the teachers (micro) level. Just like BECTA did for the United Kingdom in supporting technology innovation in schools (Gaffney, 2010), there should be a strong role played by ICT4D (ICT for Development) to comprehensively monitor progress made by ESP schools in their ICT implementation plans. Being the sector charged to oversee integration of ICT in education for the Ministry of Education, ICT4D ought to ensure sustained changes and build up of a critical mass for the required paradigm shift in adoption of technology in Kenyan schools. As expounded by the ecological theory which underpins this study, it is the interactions within and across each level that will see the adoption of ICT operate in a systemic manner. It is the policy organs that should advice the government as well as reach directly to schools (meso level) and in turn impact on what the teacher does in the classroom. Schools in turn should provide timeframes that reflect adoption of emerging technologies to the higher levels in order to realize policy goals (Gaffney, 2010). He further suggests that such accountability of one level to another provides a systematic way of monitoring how policies are aligned and integrated with the innovations.

Most of the schools with ICT infrastructure have acquired it through initiatives supported by parents, the government, NGOs, or other development agencies and the private sector, including the NEPAD e-Schools programme. For security reasons, the

ICT infrastructure in the schools are not found in classroom but concentrated in a purposely built "strong rooms' called computer rooms. Securing them in the computer rooms has an additional advantage of better control and appropriate use of the machines. Location of ICT equipment in a secured room under lock and key some distance from the classroom is in itself a deterrent to its use. Tondeur et al. (2007a) have observed that computer rooms are not as effective as they ought to be due the physical separation of computers and the actual classroom. This, they add, reduces opportunities of ICT use in teaching and learning activities. In the ESP schools, just like in many public schools, computers are not located in the classrooms, but in specially build and secured rooms. Kavagi (2010) postulates that, computers form a part of a normal classroom to be used whenever both teachers and learners want. Large classes however, are not easily or quickly relocated to the computer room.

Although technology is of great educational value, and despite of a national policy on how the technology should be integrated for teaching and learning, computers are sometimes installed into schools without sufficient consideration as to how they will be used. There is also a general inadequacy of learning resources, course curriculum and other learning materials that incorporate ICT use. According to Kiptalaam and Rodrigues (2009), most secondary schools have some computer equipment, which may be the bare minimum that consists of one computer in the office of the school head or the secretary. Very few secondary schools have sufficient ICT tools for teachers and students. Even in schools that do have computers, the student-computer ratio is 150:1. (Kiptalaam and Rodrigues, 2009). The scenario has however improved since schools have been up scaling their ICT infrastructure. In the ESP schools, the government has

provided the infrastructure under the stimulus programme of the Ministry of Education. Although the provisions made under ICT component of ESP may seem low, the guidelines given by the Ministry of education implicate that learning can be made dynamic even with a single computer. Use of a few computers per class use to maximum can be ideal for any lesson (MOE, 2013). Further, it states that lack of connectivity too should not be reason for not adopting ICT. This is because it is possible to down load information or videos and burn on a CD-ROM or DVD.

2.5 Challenges in adopting Technology in Schools

In a literature review on ICT integration, Hennessy and Onguko (2011) indicated that challenges in adoption of technology include the optional status of ICT within the curriculum, and negative attitudes among school leadership towards computers and the internet. This is possibly because it is not a core subject. They further observed that the lack of contextually appropriate course content for either teachers or learners also delays progression towards use of ICT in schools. Access to technology on its own motivates teachers to apply it in their teaching.

The biggest barriers to the use of computers are lack of time available in classes, and in their own schedules for planning due to a rigid and overloaded curriculum; and the lack of a national policy on the use of computers in schools (Kozma, McGhee, Quellmalz, and Zalles, 2004). However Kenya has an ICT National strategy as well as one specifically for education from MoEST. National policies need to make more commitment to helping teachers effectively integrate computers and internet technologies into the classroom by aligning curricula, exams, and incentives with the

educational outcomes that they hope to gain. Computers by themselves bring very little to the learning process; they are only tools for teaching and learning.

Using of computers for instruction requires that schools restructure the teaching learning approach in order to give individualized instruction required by the use of the computer technology. This is likely to meet resistance from the teacher whose main interest is to raise the mean score of the subject being taught. When implementation of the curriculum becomes too examination oriented (Kavagi, 2010; KIE, 2010), innovation of teaching methods such as use of computers which seem to 'threaten' school performance face a lot of challenges , if not actual resistance. Kavagi (p. 87) adds that; 'since innovation cannot be tested, the potential of computers in schools do not get realized even though such potential would have worked for the good of the same teacher'.

While assessing integration levels of schools, Kenya School Net (2003) investigated availability and access to the Internet. It was found out that email was yet to be recognized as a tool for collaboration among students and teachers. It went on to affirm that in the schools surveyed, access to the Internet was severely limited and when available was only for administrative use.

Groff and Mouza identified challenges associated with effective technology integration. The areas of challenge were identified as: research and policy; technology; the school (as the context); the teacher (innovator); the project (innovation); and the students (operators). They developed the following framework to help teachers predict the likelihood of success of technology-based projects while integrating instructional

innovation and identify potential barriers that can hinder their technology integration efforts;

Research and Policy
Differing expert opinion / lack of quality research
Unclear goals for policy makers, administrators, and teachers
Many technologies created without meeting real classrooms 'needs
Technology
Inherent malfunctions
Need for expertise to troubleshoot
Lack of reliable network connections
The School (Context)
Organizational culture that does not support the effective use of technologies
Lack of human support and infrastructure
Lack of technology resources and equitable access to them
Inadequate physical setup and structure for technologies
The Teacher (Innovator)
Insufficient technology skills and proficiency
Ability to access/ utilize school resources
Attitudes and beliefs misaligned with educational technology pedagogy
Inability to process through stages of concern
The Project (Innovation)
Distance from school culture
Distance from current practices
Distance and dependence from resources
The Student (Operators)
Comfort-level with technology
Student attitudes, beliefs, and engagement with the project's scope
Project distance from prior technology experiences

(Groff and Mouza, 2008)

This framework details challenges hampering adoption. On research and policy the main challenge in education are associated with the many technologies that do not meet the demands of the content in the curriculum. Technology itself is very dynamic and it may become a challenge for schools to keep up with the pace of emerging technologies. Some schools have computers that were donated to them, which sooner or later become e-waste.

On the technology itself, the fact that there is inherent malfunction is a challenge. The rate of breaking down requires technical personnel for trouble shooting and maintenance. Without a fulltime technician, sustaining the ICT in the school may become a challenge even for the school with noble intentions of adopting computer technology. The ESP schools were installed with internet connectivity which they were to maintain on a continuous basis. Lack of funds to maintain this may reduce it to dis-use. For Groff and Mouza (2008), the school context can be a challenge due to the organizational culture, lack of human resource to support, resources and infrastructure or adequate physical set up and structure for technologies. School administrators are often blamed for offering little structural support and few incentives to use the technology effectively in the classroom.

The school culture and leadership is yet another challenge that hampers adoption. The shared values and guiding beliefs of a school community, and the ways in which such understandings are reflected in the day-to-day life and organization of schools have considerable bearing on how and the extent to which change occurs in schools. This combination of beliefs and practices which comprise a school's culture is notoriously resistant to innovation, particularly when changes call for people to think, act and organize their work differently (Gaffney, 2010). In such circumstances, change such as adoption of technology is only possible where there is effective and strategic leadership (Fullan, 2005). Lack of effective school leadership fails to shape the culture of their schools in ways that foster an openness to change for the benefit of students. Fullan (2005) emphasizes that teachers do not simply assimilate new changes such as resources or alter their practices in response to extremely envisioned principles.

Challenges regarding the teachers as the innovator as described by Groff and Mouza (2008) are be associated with inadequate skill and competencies to adopt technology. Where teachers have no ability to access and utilize the resources or have no interests to diversify the teaching resources to include emerging technologies will impact negatively on adoption and remain a challenge. A further elaboration of the framework by Groff and Mouza that have an implication on the innovation have to do with the use of the technology and the services it provides to the users. Issues of its security and the pace at which the technology can flow with current or latest practice can be a challenge if not carefully checked.

2.6 Empirical Studies on ICT in Education

The core factors that influence the adoption and diffusion of ICTs in education have been identified in many studies and project reports such as the UNESCO *Meta-survey on the Use of Technologies in Asia and the Pacific* (Farrell and Wachholz, 2003) and, in the context of East Africa, by IDRC in its thorough analysis of ICT policy-making in the region (Etta & Elder 2005). Two other studies that have discussed some of these factors in the higher education sector are those carried out by the United Nations National University (Nyaki and Oyeyinka, 2002) and by the African Virtual University (Murray, 2005). What emerges from these analyses is that the factors are essentially the same in both developed and developing economies, although they differ in terms of importance depending on which side of the "digital divide" they are viewed from (Murray, 2005).

Research on factors affecting use of technology in schools commonly lists factors such as teacher acceptance, training and professional development; available, suitable, affordable, useable and reliable technology (including network infrastructure); appropriate digital content and software; clear implementation strategy; and sufficient time and other resources to sustain the change process (Condie and Munro, 2007; Lee and Winzenried, 2009; Venezky and Davis, 2002). According to Mahmud and Ismail (2008), the teacher characteristics, which include ICT skills and knowledge, attitude, perception and belief in ICT, access to ICT, age, area of specialization and ICT training, ICT skills, knowledge, and attitude were positively correlated to teacher's ICT readiness. Similarly their study also found that teachers who had received ICT training, experience in using ICT, and were relatively younger (below 40 years old) were more ready to integrate ICT in classroom teaching than their counterparts. Teachers in the area of technical and vocational are found to have more ICT knowledge compared to those teaching other areas such as science, humanities and languages. It was essential to find out whether similar situations applies in the Kenyan context and more so in ESP schools which were are greatly favored by the provision of ICT infrastructure by the government.

Research undertaken by Buchan et al (2008) highlights the relatively recent pedagogical shifts taking place as a consequence of increasingly sophisticated technologies. An implication from this research and that of Lee and Winzenried (2009) is that teachers' acceptance is a vital ingredient; and that such acceptance is reliant on how the technology links with their current practice. In a similar vein, the BECTA study by Jones (2004) highlights the interconnectedness of human and technical variables, and

the importance of teachers perceiving the educational value in the technology and having the confidence to use that technology before they use it in their teaching. Their research found that teachers will use digital teaching resources when there is time to become comfortable with the technology, and appropriate training and development, as well as ongoing professional and technical support are provided. Mumtaz (2000) supports this view in reporting that teachers who successfully used digital technologies have a positive attitude towards ICT, and encourage students' empowerment as learners rather than as recipients of instruction.

Different research findings indicate that there has been a lot of interest in the field of ICT in education in and for teaching and learning. Franklin's (2007) study of teachers' use of computers for instructional purposes identified the following factors influencing teacher use: leadership by school and district administrators; access and availability of hardware and software; incentives to participate in professional development; personnel, technical and pedagogical support; external constraints over which teachers have little or no control; and teacher pedagogical practices as well as professional preparation.

Similarly, Bingimlas's (2009) meta-analysis of the literature on perceived barriers to technology integration in science education indicated that while teachers had a strong desire to integrate ICT into education, the major barriers were a lack of time, confidence, competence, and access to resources.

In an investigation of factors affecting the use of ICT for teaching in the Western Cape schools, Chigona (2010) studied the Khanya project which has been equipping schools

and educators with ICT skills and equipment to be used in the curriculum delivery in South Africa. According to Chigona, research and anecdotal evidence had shown that there is low adoption rate of ICT among educators in Khanya schools. Analyses of the factors which are preventing the teachers from using the technology in teaching were categorized as personal, social and environmental. Just like in many secondary schools in Kenya, insufficient ICT training, lack of freedom to access the laboratories, inadequate technical support and insufficient equipment (computers) in the laboratories which leads to the learners crowding in front of the few machines results in low adoption. This study was done in ESP schools in Kenya which is a similar situation, although not necessarily as a project.

2.6.1 Empirical studies in Kenyan Secondary Schools

Recent study on pedagogical integration of ICTs in Kenya include that by Kidombo et al (2009) which showed a good picture of ICT access in schools at a ratio of 1:24. However, this study cannot be generalized to all learning institutions because the study sampled very few schools (ten), all of which were already utilizing computers. Wanjala (2010) explored teacher technology adoption and concluded that factors affecting acceptance among teachers included attitude, self confidence, perceived relevance, pedagogical practices and policy formulations. However these determinants were limited to Mathematics teachers who are in a limited geographical zone.

According to Mwaura (2011), there are low literacy levels of ICT among school managers and schools too have limited resources. This study on ICT utilization for curriculum management laid emphasis on school management. Unlike the current study, it focused on a different cluster of schools and was done in a limited area too. This

study had a wider scope in specific schools that had the basic ICT infrastructure and enhanced teacher capacity in ICT. Observations made by Omwenga et al (2004) considered issues and implications of ICT-supported learning with regard to pedagogy in the teaching and learning process. The context of developing ICT methodologies and strategies which can be integrated into the teaching and learning process within schools and higher learning institutions have been considered and solutions to ameliorate the situation suggested. Similarly, Nengo (2012) did a study on factors influencing computer based teaching in secondary schools. However, their scope of study was limited to particular geographical areas and at the level of the teachers. In comparison, this study has a wider scope and goes beyond teacher factors.

A survey done for teachers in sub-Saharan Africa shows clearly that majority of teachers were ill equipped to effectively integrate ICT in classroom (Hennesy and Onguko, 2009; Oloo, 2009) The main challenge for teachers interviewed was lack of adequate number of computers, educational applications, training, policy and strategy on how integration should be done. Unlike these studies that consider a wide African perspective, this study has specifically considered secondary schools in Kenya.

Skills upgrade for teachers' integration of ICT have concentrated on basic computer skills and missed out on pedagogical /didactical principles (Loveless; 2000). This lack of pedagogical principles was also noted by the Teacher Education Professional Development (TEPD) report (MoE, 2008) and could be a contribution as to why lecturers in Primary Teacher Training Colleges (PTTCs) do not expose teacher trainees to ICT integration. Only ICT lecturers use the computer technology during the lesson, since other lecturers lacked the competence to do so. Further, attention both on policy

and research concentrate on lack of infrastructure and access to technology as affecting use of ICT in pedagogy (Koo, 2008). Although the TEPD study has given mention to use of ICT in curriculum, it has concentrated on PTTCs, without giving attention to secondary school level which this study did.

In an evaluation of the secondary school curriculum, KICD observed that the delivery of education must of necessity embrace a technological platform (KIE 2010), otherwise Kenya as a developing country risk being marginalized in a competitive global knowledge economy because the education and training system is not equipping learners with the skills they need for the 21st century (Hanushek and Kimko, 2007 as cited in KIE, 2010). This study therefore concentrated on technology that secondary schools have embraced so far under the ESP programme.

Monitoring and evaluation done by MoE in the ESP schools revealed that in most of the schools, teachers were not using ICT tools because they lacked the basic computer manipulation skills and the training offered by ICT champions was found inadequate. In some areas, the computers acquired and tools installed were of poor quality (MoE, 2012). The study further found that in many of the schools, the space in the ICT rooms was inadequate. Power supply in some schools was intermittent thus hindering effective use of ICT tools. Most teachers, though trained by the ICT champions, hardly used the ICT tools primarily for the intended purpose as tools in facilitating classroom instruction. Instead they used them for activities such as teaching Computer Studies, setting examinations, entering and recording marks. Though relatively close to the subject of this study, the study conducted by MoEST concentrated on infrastructure. It was not very specific on the characteristics of neither the teachers nor the contextual

factors in the schools in the adoption of computer technology as pursued by this study. However, this study took cognizance of the study conducted by MoEST.

A recent research done by KICD (2013) on the use of digital content in ESP schools indicates that most teachers in these schools have some experience and competence in using computers. Learners too have access to computers in their schools but rarely used them except for few students taking computer studies and the science subjects. These studies however observed that the computers get used mainly for administrative activities. Teachers are yet to fully integrate the ICT in instruction due to their personal beliefs and emphasis on syllabus coverage and mean score.

There is also the presumption that use of technology demands too much of their time which they would rather use to 'cover the Syllabus'. In the long run, technology remains part of schools infrastructure, well secured and used by a few teachers and students. It observed that most schools under the ESP programme had inadequate infrastructure (KICD, 2013). However they were able to use what they had for different purposes, mainly administrative and downloading learning content from the internet. Although the study was conducted in ESP schools in Kenya, its concern was mainly on use of interactive digital content from KICD. It neither discussed the teachers' characteristics nor the school context which this study has explored in depth.

2.7 Chapter Summary

Due to the complexity of factors that mediate and moderate technology use, any organization or population considering the implementation of a technology innovation must be able to develop a process to handle various personal aspects and concerns,

whether these are cognitive, affective and contextual (Straub, 2009). Cognitive concerns include how compatible an innovation is with existing understandings of how the innovation will benefit the users' current task understanding. Affective concerns have to do with attitude, perceptions and beliefs, while contextual is about the environment where the technology adoption is taking place; in this case the schools.

Indeed, ICT researchers have traditionally focused on various individual teacher characteristics or factors. This largely ignores the social context in which teachers operate. In this context, the study by Zhao and Frank (2003) shows that few ICT integration studies have examined important school level variables that may affect the use of ICT for teaching and learning. In line with this view, Tondeur et al. (2007a) have urged for research that focuses on specific school conditions and variables that may explain the use of ICT in classrooms. In this study therefore, the individual characteristics of the teacher within the context of the school and their relative influence on adoption of computer technology are essential. That is why the review of related literature has focused on specific areas on teacher characteristics and contextual factors within the school set up.

The sources of the literature included published journals, books, reports of meeting proceedings and training manuals as well as empirical studies. The purpose of reviewing the literature in these areas was to look at documents that are theoretically sound, valid and reliable to review what had been done in order to identify gaps in relation to this research and to identify aspects that received inadequate focus in adoption of ICT in schools.

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

3.0 Introduction

This chapter discusses the methodological procedures undertaken for this study. It outlines the epistemological position, paradigm used, research design, the target population, sample and sampling procedures, data collection instruments, data collection procedures and data analysis methods used.

3.1 Study Settings

The researcher needed schools that had homogenous characteristics in as far as ICT adoption was concerned. The ESP secondary schools with the ICT component had similarities in the way the programme was implemented. The schools were distributed throughout the country, hence the study's choice to reach different parts of the country. The study area therefore included different geographical regions as shown in appendix 4 in this thesis.

3.2 Epistemological Perspective

Epistemologists often concern themselves with the status of knowledge and experiences of knowing. Knowing can be seen as the action participated in by the learners and knowledge is not external sourced. What is learnt reinforces what is already known. Use of Information Technology (IT) for curriculum delivery in schools is inclined towards

the learner centred environment which is based on the theory of constructivism. Constructivist approaches to teaching and learning have emerged from the work of psychologists and theorists such as Piaget and Bruner. This theory expounds on how individuals construct meaning based on prior knowledge and experiences. Teachers who teach using learner Learner Centred Pedagogies (LCP) are conscious of the fact that learning is based on prior knowledge while the teacher remains a facilitator. These classical theorists therefore advocate for constructivism and suggest that teachers should consider knowledge and experiences that learners bring with them to the task which can be expanded and developed by new learning.

Regardless of how psychologists and other theorists classify it, constructivism is concerned with how personal understanding or knowledge is formed. It is a method that is innovative, interactive and learner driven. Education reform efforts that take advantage of the affordances of ICT promote constructivist and social constructivist teaching approaches and emphasize students as active constructors of knowledge in collaborative settings (Jonassen, Howland, Marra, & Crismond, 2008; Chai, Koh, & Tsai, 2010). Brooks, Matsuoka and Doyle (2004) report an ongoing interest in constructivism, which among other things, promises to help learners become thinkers who grasp and apply concepts. When knowledge is constructed by learners, learning is not passive; it is active. Learners confront their understanding in light of what they encounter in a new learning situation. Learners are therefore seen as active knowledge constructors rather than passive information receivers (Jonassen, 1991).

Another contributor to the collective conceptualization of constructivism is Lev Vygotsky. The most recognized of Vygotsky's social learning theory (or social constructivism) is the Zone of Proximal Development concept. He laid the groundwork for learners to utilize a social support system as a kind of learning process whereby one can bridge the gulf (or zone) that exists between what one knows and what one needs to know (Bruner, 1986). Use of ICT by learners raises them from a low level in relation to their ICT teachers, mentors or peers who are better than them. Such an environment is provided for in the ESP schools.

The implementation of constructivist ideas in classrooms and other learning environments is important because knowledge and skills that a learner brings to the learning experiences is important. Jonassen et al (1991) noted the implications that implementing constructivism has on the role of teacher and student. Specifically, students must wrestle with the responsibility that comes from being in charge of one's own learning. Although some students reticently assume this responsibility and even see as though they are wasting time, when given the opportunity, most of them enthusiastically share their constructs with those of other students, often engaging in lively discussions that lead to learning. Crucial ideas around the notion of constructed knowledge is that learners construct new understandings using what they already know and that learners come to learning situations with knowledge gained from previous experience. It also emphasizes that prior knowledge influences what new or modified knowledge they will construct from new learning experiences (Hoover, 2001). Meanwhile teachers shift to a more facilitative role rather than serving as information dispensers. This role of a teacher can be summed up in the words Brooks and Brooks,

(1994), "...to challenge and empower students to ask their own questions and seek their own answers… and to understand the world complexities" (p. 5).

Constructivism has important implications for teaching. First, teaching cannot be viewed as the transmission of knowledge from enlightened to unenlightened; constructivist teachers provide students with opportunities to test the adequacy of their current understandings (Hoover, 2001). In constructivist teaching students are fully engaged, and teachers too can give a meaningful account of the time used in the classroom. Secondly, learning based on prior knowledge, implies teachers must note the knowledge and provide learning environments that exploit inconsistencies between learners' current understandings and the new experiences before them. Teachers however cannot assume that all learners understand something in the same way, or that learners need the same experiences to advance to next levels of understanding.

When students need to apply their understandings in new situations in order to build new knowledge, then teachers must engage students in learning. They are both fully engaged in the process. Teachers can ensure that learning experiences incorporate problems that are important to students, and also encourage group interaction, where the interplay among participants helps individual students become explicit about their own understanding by comparing it to that of their peers. Cognitive constructivists acknowledge individual differences and even individual groups, if given similar conditions, they can construct different knowledge. Constructivism takes learners as active agents of their own learning rather than passive recipients and respondents of stimuli (Perkins, 1992).

If new knowledge is actively built, then time is needed to build it. Ample time facilitates student reflection about new experiences, how those experiences line up against current understandings, and how a different understanding might provide students with an improved view of the world. In order to provide learners with environments to built knowledge, the teachers should be motivated in creating their own knowledge as well.

3.2.2 Constructivism in ICT

This study adopted the epistemological position of constructivism. Constructivist epistemology is entirely consistent with inquiry approach which ICT is modeled upon, due to its hands on and interactive nature (Brooks et al. (2004). Brooks et al. advanced that, "Constructivism is not a theory about teaching...it is a theory about knowledge and learning... the theory defines knowledge as temporary, developmental, socially and culturally mediated, and thus, non-objective" (p. vii). As a matter of fact therefore, ICT use renders itself to student centred learning.

Since learning is a constructive process, instruction must be designed to provide opportunities for such construction. The contemporary constructivist theory of learning acknowledges that individuals are active agents, they engage in their own knowledge construction by integrating new information into their schema, and by associating and representing it into a meaningful way. Constructivists argue that it is impractical for teachers to make all the current decisions and dump the information to learners without involving them in the decision process and assessing learners' abilities to construct knowledge. In other words, guided instruction suggested puts learners at the center of learning process, and provides guidance and concrete teaching whenever necessary.

Perkins (ibid) indicates that students may easily get lost in management without any experience to guide them through the information jungle. This is why use of computers becomes guided creation of knowledge by the learners themselves. Teachers who guide learners need to be hands on themselves, with experiences and competence in computer technology. This is because there is depth rather than breadth in learning with and through computers (Brooks et al. 2004)).

Recapitulating the main principles of constructivism, we could say that it emphasises learning and not teaching, encourages learner autonomy and personal involvement in learning, looks to learners as incumbents of significant roles and as agents exercising will and purpose, fosters learners' natural curiosity, and also takes account of learners' affect, in terms of their beliefs, attitudes, and motivation (Jonassen, 1991). In addition, within constructivist theory, context is accorded significance, as it renders situations and events meaningful and relevant, and provides learners with the opportunity to construct new knowledge from authentic experience. Learning through ICT therefore, is about manipulation of ICT tools, where teachers need to redefine their role in the learning process by stimulating students to work and learn in self-sustained, responsible and autonomous ways (Hennessey et al, 2010).

There is therefore need for teachers to shift towards a student-centered paradigm which has become the current emphasis on the 21st Century skills. The importance of these skills cannot be underestimated. Seng (2003) posit that the advent of globalisation and the blistering pace of technological advancement in ICT have made these skills essential if one is to remain competitive in a fast-changing world.

3.3 Research Paradigm and Approach

Paradigms serve as the philosophical "anchor" of social inquiry, providing the research designs within which assumptions are grounded about knowledge and the social world (Smith, Thorpe and Jackson; 2008). Three world views were considered as possible paradigms for this study; positivism, interpretivism and pragmatism. For positivism the key idea is that the social world exists externally and should be measured objectively since knowledge is based on observed facts (Smith et at., 2008). As a reaction to position held by positivists, social constructivists claimed that people make sense of their world through sharing experiences through interpretivism, "reality in this case is socially constructed and given meaning by people through their experiences" (Smith et al., 2008, p.58). On the other hand, for pragmatism Smith et al posit that there are no predetermined theories or frameworks that shape knowledge and understanding. It is a synthesis of features found in positivism and interpretivism.

This study adopted a pragmatic approach which is the philosophical stance for a mixed-method approach (Creswell and Plano Clark, 2007). The mixed methods approach is underpinned on the dialectic stance, in which the qualitative and the quantitative paradigms act as important frameworks for inquiry practice, and the findings are invoked by juxtaposing different paradigms to generate more complete, more insightful research understandings. The study took on this philosophical paradigm since it sought to combine both positivist and interpretivist approaches in finding out individual and contextual concerns in computer technology adoption in secondary schools in Kenya. Meaning gathered from the experiences of the respondents were collected therefore using quantitative and qualitative data at different stages of inquiry.

The mixed methods approach adopted in this study was been defined by Tashakkori and Creswell (2007) as: "research in which the investigator collects and analyses data, integrates the findings and draws inferences using both qualitative and quantitative approaches or methods in a single study" (p 4). The mixing of methods occurs both at the philosophical and at the methodological levels. Research in this approach, is not restricted by the use of traditional approaches to data collection but is guided by a foundation of enquiry that underlies the research activity (Beland and Cox, 2011). Cresswell's (2009) observation that "…for the mixed method research, pragmatism opens the door to multiple methods and world views as well as different forms of data collection and analysis" (p.11) clearly explains why this study lends itself toward the pragmatism approach.

This study was based on both the quantitative and qualitative approaches simultaneously. This is referred to as QUAN-QUAL model (Gay, Mills and Airasian, 2009; Cresswell and Plano Clark, 2007) where equal weighting is given to both methods and data is collected concurrently. It is also known as the triangulation mixed method design. The use of this mixed method approach was important because of the need to explore in depth the views of the respondents. The corroboration and triangulation of information from different sources enriched the findings and strengthen interpretation and conclusions drawn for the study. The quantitative methods used generated quantifiable data that were generalized. These were given meaning by viewpoints generated from details of qualitative methods. The quantitative aspects mainly entailed the use of structured questionnaires while the qualitative aspects involved the use of semi structured questionnaires and

interviews. This study concurs with Onwuegbuzie and Johnson (2004) who summarizes the philosophical position of mixed method researchers when they stated: "We agree with others in the mixed methods research movement that consideration and discussion of pragmatism by research methodologists and empirical researchers will be productive because it offers an immediate and useful middle position philosophically and methodologically; it offers a practical and outcome- orientated method of inquiry that is based on action and leads, iteratively, to further action and the elimination of doubt; and it offers a method for selecting methodological mixes that can help researchers better answer many of their research questions (p.17).

3.4 Research Design

This study adapted a cross-sectional survey design using mixed methods approach. Usually the purpose of using this type of survey is to generalize from the sample population so that inferences can be made (Creswell, 2009). The cross-sectional design was considered appropriate as it allowed the researcher to collect data at one given point in time. It also allowed the concurrent use of both quantitative and qualitative methods of collecting data to complement each other. According to Gay et al (2009), the survey design is appropriate when providing a snapshot of current behaviors, attitudes and beliefs in a population at a single point in time. Creswell too, emphasizes this when he points out that this is an economical design which allows for rapid turnaround in data collection.

A survey design is used in studying reasonably large populations by selecting representative samples for observation and analysis (Cooper and Schindler 2003). Such designs are concerned with describing, recording, analyzing and reporting conditions that currently exist in a population (Gay et al, 2009). The design was therefore relevant to this study because it allowed observation and description of the ICT pedagogical approaches of individual teachers within the school context with respect to adoption of computer technology in the target institutions.

3.5 Target Population

Target population refers to the entire group of individuals from which a sample is drawn for measurement (Kombo & Tromp, 2006). As such, the target population for this study was the secondary schools which are under the Economic Stimulus Programme (ESP) by the Ministry of Education Science and Technology (MoEST). The study targets the 1,021 public secondary schools that received ICT infrastructure in phase one of the programme. The study targeted the 10,210 ICT trained teachers in ESP schools as well as the head teachers and learners.

3.6 Sample and Sampling Procedures

A sample is a proportion of the population from which data is gathered (Smith et al, 2008). Sampling is done to facilitate collection of data from the population. It is the procedure used to gather people, selected from the population, who share similar characteristics with the population (Kombo & Tromp, 2006). There are 5127 public secondary schools in Kenya (MoE, 2010). However, only 1021 were provided with the

ICT infrastructure in phase one under the Economic Stimulus Programme (ESP) from MoE in 2009. A list of these schools is in appendix 3.

Multistage sampling was used in this study. This involved selection of samples in stages. Stratified sampling was first used to categorize the regions with ESP schools into five units; Northern, Eastern, Western, Southern and Central. Northern catered for parts of North Eastern former province, Eastern covered parts of the former Eastern province, Western cluster catered for parts of Western and Nyanza and Rift Valley former provinces, Southern catered for parts of Coast and lower Eastern provinces, while Central catered for Nairobi and parts of former Central provinces.

From every cluster, counties were clustered and sampled proportionately from each region to yield a total of 29 counties. Proportionate sampling was ideal since some regions have more counties than others. Ninety seven ESP schools spread out in all the 29 counties were sampled yielding 10% of the total number of ESP schools. According to Gay et al (2009), 10% is acceptable sample for a homogeneous group. This group of schools was homogenous in that they had similar characteristics which were set as requirements and standards from the Ministry of Education before receiving the infrastructure. Proportionate sampling was used to cluster the schools in each of the sampled counties. Simple random sampling method was used to identify three schools in each county. Table 3.1 shows the sampling frame of the counties and schools.

Table 3. 1

Sampling Frame

Region	Counties			Schools		
	Total	**Sample**	**(%)**	**Total**	**Sample**	**(%)**
Rift Valley	15	9	60	225	27	12
Eastern	8	5	63	175	16	9
Nyanza	6	4	67	162	14	9
Central	5	3	60	144	12	8
Coast	5	3	60	102	9	8
Western	4	2	50	128	10	8
NEP	3	2	67	45	5	11
Nairobi	1	1	100	40	4	10
Total	**47**	**29**	**62**	**1,021**	**97**	**10**

Source of ESP schools: MoEST (Appendix 4)

The 29 counties were as follows;

Western; Kisii, Nyamira, Siaya, Kisumu, Bungoma, Kakamega, Baringo, Bomet, Kericho, Nakuru, Nandi, TransNzoia, Uasin Gishu, Narok, Kajiado.

Eastern region: Embu, Tharaka, Isiolo, Meru

Southern: Kilifi, Mombasa, Kwale, Kitui

Central: Nairobi,Kiambu, Nyandarua, Nyeri

Northern: Garissa, Wajir

Although schools were identified by the MoEST through the former 210 constituencies in the year 2009, this study used counties to sample the geographical locale of the schools in tandem with the current system of government. In each of the 1,020 ESP schools, at least 10 teachers were trained on integration of computer technology in

teaching and learning. The ICT trained teacher population was therefore estimated at 10,200. Using the sampling frame adapted from Krejcie and Morgan, in The Research Advisors (2006) shown in appendix 1, the appropriate sample determined was 370 teachers for at 95% confidence level and 5% margin of error.

In every school, a minimum of three ICT trained teachers were selected through simple random sampling method. All the head teachers of the sampled schools were part of the study. Four students were randomly identified to represent both genders in Forms 2, 3 and 4 classes. Simple random methods were used as they gave all respondents an equal chance of participating in the study. However, the Form One class was considered relatively new to secondary curriculum and learners in this class may not have interacted with the ICT resources long enough to give sufficient feedback. The Form One class was therefore not sampled.

In total, 97 head teachers, 370 teachers and 382 learners were sampled to participate in the study. Four officers were sampled purposively as representative of MoEST. It was necessary to include personnel that has been in charge of provision of the ICT infrastructure, training teachers and providing e-content to schools.

3.7 Data Collection Instruments

Qualitative and quantitative methods were used to collect data. The use of varied instruments was useful for triangulation purposes. In mixed method research, use of both types of tools is essential for better understanding of the research problem (Creswell and Plano Clerk, 2007). The instruments that were used in this study included

structured and semi structured questionnaires and unstructured interview schedule. These were developed and piloted before the main data collection exercise.

3.7.1 Questionnaires

These are self administered written collection of survey questions to be answered by a selected group (Gay et al., 2009). The self administered questionnaires were given to the head teachers, teachers and learners. The tool was considered suitable in this case because of its advantages that included administering to many respondents and who geographically spread widely across the sampled institutions. It therefore saved on time, effort and expenses as expressed by Drew et al. (2008). One of the disadvantages of using a questionnaire is its assumption that the respondent can read and write. However, the respondents for this tool were in secondary schools and could therefore clearly read and understand the questions.

3.7.1.1 The head teachers' questionnaire

The head teachers' questionnaire was unstructured. It had both open and closed ended items, which therefore enabled gathering of both qualitative and quantitative data. The tool first sought a respondent's bio data, after which it gathered questions based on the objectives of the study. A copy of this instrument is appended as appendix 2A.

3.7.1.2 Teachers' questionnaire

The teachers' questionnaire was structured as the items therein were closed. Possible statements were provided in relation to the objectives of the study and

respondents were required to strongly agree, agree, disagree or strongly disagree in a five point likert scale. This tool had five sections; the first provided demographic data while the rest provided information for each of the study objectives. Section 'B' was about how computers are used in schools. This section sought information about access by both the teachers and learners, frequency of use and location of the computers and accompanying resources. The third and fourth sections were about the school context and teacher characteristics respectively and were to elicit responses for objective three and four. Section five was on challenges encountered and the items sought responses for objective five. A copy of the teachers' questionnaire is appended in Appendix section as 2B.

3.7.1.3. Learners' questionnaire

The learners' tool collected data in order to triangulate information given by teachers. It sought information on their access and use of the computers and related technology, as well as their opinions on school contexts and how their teachers relate to them during the lessons that integrated computers. A copy of the questionnaire used is appended as Appendix 2C.

3.7.2 Unstructured Interviews

Interviews are oral one to one question and answer sessions using personal contacts and interactions to gather necessary data (Drew et al., 2008). During interviews, one is able to obtain data through non verbal cues and also have follow up questions and probes to provide more in depth information (Gay et al., 2009; Smith, Thorpe and Jackson, 2008). Unstructured guidelines were therefore made which had a set of open ended items that

related to the study objectives. As noted by Smith et al. (2008), the aim of unstructured interviews captures meaning and interpretation of a phenomenon in relation to the interviewee world view.

The interviews for this study targeted ICT officers in the Ministry of Education headquarters (MoEST), ICT teacher trainer at Kenya Education Management Institute (KEMI) and the personnel in charge of e-content development at Kenya Institute of Curriculum Development (KICD). These personnel are crucial because they were involved in the provision of the ICT resources, the training for teachers and the development of content since the ESP began in 2009. These respondents were subjected to the interview schedule. The schedule had specific open ended items that dwelt on provision of the infrastructure, its adequacy, role played by the Ministry of Education in preparing teachers for adoption and uses of the technology in schools. It also sought their opinion on teachers' characteristics and contextual factors that may influence or inhibit adoption of the computer technology.

Conducting interviews can be challenging due to the expenses involved (Drew et al. 2008). However, this study considered it important to have the interviews since the officers were few and in depth responses were not only possible but necessary. Among the advantages of interviews is that a rapport gets established between the researcher and respondents. This study made use of this advantage by creating a rapport which allowed eliciting of technical information and assured the researcher of high rate of responses, as well as complete and usable returns. Further, any issues that lacked clarity were sorted out, while prompting and probing in the open items provided flexibility and

exploration of new issues that were not anticipated. The interview guide is appended as appendix 2D of this thesis.

3.8 Piloting of the Research Instruments

The research instruments were piloted in five institutions similar to the actual schools used for data collection. Drew at al. (2008) observed that this aspect of research is not only desirable but necessary so as to revise tools based on its results. The schools were selected from Nairobi and Machakos counties. The process provided information regarding whether the instructions and questions were clear and whether time and effort involved were reasonable. The five ESP secondary schools had similar characteristics with, the sampled institutions, but were not involved during the main data collection exercise. From each school three teachers, four students and the head teachers responded to the questionnaire. In pilot testing of tools, the researcher was be able to correct errors of omission or commission as well as receive information about deficiencies and suggestions for improvement (Gay et al., 2009). The pilot ensured that there was a common understanding among respondents and identified any challenges the larger sample was likely to pose. The items were therefore adjusted accordingly. It also provided a realistic sense of how long each tool would take to administer, whether instructions were clear and understood, and if they were valid and reliable.

3.8.1 Validity

Instruments are valid if they do what was intended. Validity therefore is the extent to which an instrument measures what it purports to measure in order to interpret the scores appropriately (Burns and Burns, 2008). Two types of validity were considered in

this study; that is content validity and construct validity. The content validity is the degree to which a tool measures an intended content area. The items must be relevant to the measurement of the intended content. During the pre-testing of tools in the pilot schools, the respondents were free to comment on the wording of questions and viability of the statements. The length of time taken to respond to the instruments was also estimated. The tools were also given to ICT curriculum developers whose expertise helped in examining the items so that they can elicit focussed and meaningful responses as per the variables under investigation. The supervisors also gave their professional input on the relevance and appropriateness of the tools. This was also to ensure that the items were developed based on the research objectives.

Construct validity is the degree to which a test measures an intended construct. It is done to see whether the presumed construct is what is being tested. Construct validity involves relating a theoretical concept to a specific measuring device (Burns and Burns, 2008). It asks what the tool is measuring and whether the scores have a useful purpose and positive consequences when they are used in practice (Creswell, 2009; Mugenda and Mugenda, 2012). Construct validity was done by comparing the items in the tools with theoretical expectations and hypothesized behaviour to see how well they fitted. Clear definition of constructs was operationalized so that the study gets hinged on the correct interpretation of the concepts. Since the constructs must be internally consistent, and at least exceed an alpha of .50 in item correlations (Burns and Burns, 2008), the cronbach alpha of the tools in this study were above the 0.50 rule of thumb recommended by Burns and Burns for construct validity. The items in the tools were also developed based on the research objectives.

3.8.2 Reliability

Reliability refers to consistency of the research instruments to ensure that the study is reliable. Tools used need to yield consistent results when repeated under the same conditions. The reliability coefficient was calculated using coefficient alpha as proposed by Cronbach (1951) in Fraenkel and Wallen (2000) and Kothari (2003). This calculates internal consistency that ranges from 1.0- zero (0). It is suitable when questionnaire items have many scores. Cronbach's alpha was conducted on the entire survey instrument (all subscales combined) and on each individual subscale. Reliability analysis was conducted on piloted survey instruments prior to the data collection. This was done in five schools where data was collected from 15 teachers and 20 learners.

The results of the analysis learners instrument showed the Cronbach's alpha $\alpha = 0.614$, while the analysis of teachers' instrument showed the Cronbach's alpha $\alpha = 0.694$. This measure of reliability is above 0.600, which represents the minimum acceptable reliability measure for a useful instrument (Fraenkel and Wallen, 2000). The teachers' and learners' instrument were therefore considered acceptable in providing consistent data for use in this study.

3.9 Ethical Issues

Ethical issues were adhered to throughout the study. Informed consent was obtained from all the participants who were requested to voluntarily provide data. After submitting the final proposal to the office of the Dean of the school of Education at the university, and introductory letter was provided to the researcher. This facilitated the obtaining of a data collection permit from the National Council of Science in the

Ministry of Higher Education Science and Technology (MoHEST) for the researcher. This approval was necessary to ensure the researcher worked within legally acceptable limits. The consent to collect data was sought from both relevant authorities and the institutions.

In each encounter with respondents, participants consent was sought verbally and explanation for the study provided. As consent was sought, the purpose of the study as well as identity of the researcher was provided. They willingly provided the required responses. The respondents' willingness to respond to the tools was seen as an indication of adequate consent (Drew et al., 2008; de Vans, 2003). Personal identities of respondents were not disclosed and their interests and rights were protected by maintaining their confidentiality and anonymity. Study participants have complete anonymity when their identities are kept hidden. This assurance was provided in the introductory part of the tools.

Ethical standards enjoined virtues of honesty such that no data was fabricated in the analysis and report writing what so ever. Honesty and respect for others are deontological ethics which addressed basic values such as honesty and respect for others (Gall, Borg and Gall, 1996). The results were reported as indicated by data collected while any information in literature was referenced and the authors acknowledged.

3.10 Data Collection Procedures

The researcher sought an introductory letter from the School of Education at Moi University. This enabled the researcher to apply for a Permit from MoEST seeking

permission for the data collection to take place. Prior to data collection, research assistants were oriented on the tools and briefed on the process that would elicit required information from respondents. Data collection was conducted through initial visit to office of the county Directors of Education to allow access to the schools. Once visited, the head teachers in the ESP schools were informed of the purpose of the study and requested to avail the teachers and learners to respond to the tools.

The officers form the MoE, KEMI and KICD were sought through their departmental heads and interviewed. Due to their busy schedules, appointments had to be made before conducting the in depth interviews. This information was necessary in order to triangulate information from the respondents from the ESP secondary schools.

3.11 Data Analysis

The raw data was coded and then entered on as Statistical Package for Social Sciences (SPSS) platform. Both the descriptive and inferential statistical measures were used to report the findings. The descriptive data delineated general characteristics of respondents as well as frequencies, percentages, means and standard deviations. For inferential analysis, factor analysis was used to determine the constructs within the rating scales in the questionnaires as well as reduce the large size of items in the likert scales.

Regression analysis was used to determine the predictor variables in the two levels and their unique contribution in predicting adoption. Regression analysis was adopted after ensuring that key assumptions had been met (Burns and Burns, 2008). These assumptions were;

i) That the number of cases is sufficient enough. The number of Independent variables (IVs) was six against 251 teachers, on one level and 12 on the contextual level from 70 schools.

ii) Outliers were identified and removed during data cleaning so that they don't affect accuracy of the predictions.

iii) Difference between obtained and predicted Dependant Variables (DV) was more or less normally distributed and variance for residuals was the same for all predicted scores (homoscedasticity). This is as shown in the residual scatter graph and histogram.

Multilevel analysis was used to examine the relative prediction of the two levels. This was to help in providing the effects of each in the context of one and the same analysis. MLwiN was used to decompose the relative contribution, where one level (individual) was nested within the other level (contextual) and their variability in the outcome variable. Quantitative analysis was complemented by the qualitative from the interviews and unstructured questionnaires so as to make the findings more comprehensive.

3.12 Study variables

There were two main Independent Variables (IV's) or predictor variables; that is, the teacher characteristics and the contextual factors. Teacher characteristics were explained by the constructs gender, teaching experience, duration or experience of computer use by teachers, teaching subject, age and level of competence in computer use.

Contextual factors were explained by ICT resources, administration support, learner motivation, perceptions on value of ICT in learning, technical support, school policies and access; adequacy and access as well as the changes observed by learners as a result of ICT in their schools, adequacy of computers, the teacher student ratio, if the school had computers before receiving those under ESP, number of teachers trained, training received by the head teacher in ICT as well as the usage of the computer technology in the school.

Adoption of computer technology was considered as the Dependent Variable (DV). It was a function of the individual characteristics as well as contextual factors. Adoption was considered in terms of access of ICT to teachers and learners, usage of ICT resources, frequency of use and teachers attitudes or opinions. Table 3.2 presents a table of specification summarizing study variables and modes of analysis.

Table 3. 2

Summary of Variables and Modes of Analysis

Objective	**Variable**	**Indicator**	**Type**	**Measurement (instrument)**	**Analysis**
Establish extent to which computer technology has been adopted in ESP schools	adoption(DV)	Access, usage, frequency, attitude	Ordinal Rating scale	Likert scale Discussions	Quantitative Qualitative
Determine extent to which individual characteristics influence adoption of technology in teaching and learning	Individual characteristics (IV)	Gender, teaching, experience, age, duration of use, subject taught, competence	Ordinal Rating scale	Likert scale Option items	Quantitative
Assess the extent to which contextual factors influence adoption of computer technology in the ESP schools.	School context (IV)	ICT resources administration support, learner motivation, perceptions on value of ICT, technical support, school policies, adequacy and access, changes observed, teacher student ratio, training, uses	Ordinal Rating scale	Observation Likert scale Discussion	Qualitative Quantitative
Establish the relative influence of the individual characteristics and contextual factors in adoption of computer technology in teaching and learning	Individual and context		Ordinal Rating scale	Likert scale	Quantitative
Determine challenges experienced by the ESP schools in adoption of technology in teaching and learning.	Challenges	Internet support, policy and access, teachers' inadequacies	Ordinal Rating scale	Likert scale	Quantitative

3.13 Chapter Summary

This chapter outlined the design and methodology used in this research study. It started by discussing constructivism as its epistemological perspective. Curriculum delivery using ICT which this study was pursuing is inclined towards learner centred methods of teaching. These methods are based on the theory of constructivism.

The research paradigm adopted in the study was the pragmatic approach which is the philosophical stance for a mixed method approach, as advanced by Cresswell and Plano Clark (2007). This stance was adopted as the study combined both positivist and interpretivist approaches in finding out individual and contextual factors in adoption of computer technology in Economic Stimulus Programme (ESP) secondary schools.

Study design was cross- sectional survey which allowed the researcher to collect both quantitative and qualitative data at one given point in time. The target population comprised the 1021 secondary school under the first phase of the ESP- ICT component of the Ministry of Education, Science and Technology (MoEST). These are public secondary schools that were provided with ICT infrastructure for instructional and administrative uses. Multistage sampling was used to identify the schools within the clustered regions and counties.

Data collection tools included self administered structured questionnaires for the teachers and learners while head teachers responded to an unstructured questionnaire. There was an in depth- interview conducted for officers from various departments of MoEST. The research instruments were piloted before the main data collection exercise. As validity and reliability were ensured, research ethics too were adhered to. Data

analysis followed a procedure of coding and entering data on an SPSS platform, followed by cleaning and analysis. First, descriptive analysis was done using cross tabulations, means and standard deviations. It was followed by inferential analysis done using factor analysis and regressions. Further analysis of the two levels was further computed using MLwiN software.

The study variables were teacher characteristics and contextual factors as the Independent variables while adoption of computer technology as explained by access, usage, frequency and teachers attitudes on adoption as the dependent variables.

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION, INTERPRETATION AND DISCUSSION

4.0 Introduction

This chapter presents the data analysis, the interpretation of findings and discussion. Both quantitative and qualitative data gathered during the study have been presented. Although the two approaches to gathering and analyzing data differ, they complement each other in terms of triangulating the results and thus strengthening the findings. The quantitative findings have first been presented followed by its interpretation and a description of the qualitative data where necessary. This was done based on the following objectives for the study.

i) To establish the extent of adoption of computer technology in ESP schools.

ii) Determine the extent to which individual characteristics predict adoption of technology in teaching and learning.

iii) Assess the extent to which contextual factors predict adoption of computer technology in the schools.

iv) Establish the relative influence of the individual characteristics and contextual predictors in adoption of computer technology in ESP schools.

v) The individual and contextual challenges experienced by the ESP schools in adoption of technology in teaching and learning.

4.1 Response Rate

A total of 70 head teachers, 251 teachers, 337 learners and four (4) MoEST officers participated in the study. Table 4.1 shows the response rates for the different categories of respondents.

Table 4. 1

Response rate

Sample category	Target	Respondents	Response rate (%)
Head teachers	97	70	72
Teachers	370	251	68
Students	388	337	87
MoEST officers	4	4	100
Total	859	662	77%

The overall response rate as shown on Table 4.1 is computed at 77%. The response rate is above the acceptable rate for a representative sample of a target population. According to McBurney and White (2010), most researchers require at least a 50% return rate before considering a survey as representative.

4.2 Characteristics of Respondents

This section looks at the profile of the respondents. It provides general information on respondents for the study. These were obtained from all respondents' demographic data and analyzed to provide descriptive information. The following Table 4.2 shows the categorization of respondents from the ESP schools;

Table 4. 2

Type of Respondents from ESP Schools

		Type of respondent			Total	
		Teachers	Learners	Head teachers	F	(%)
gender	Female	67	160	26	253	38
	Male	184	177	44	405	62
Total		251	337	70	658	100

The Table 4.2 shows a total of 658 respondents from the ESP schools, among the teachers, learners and head teachers. Of these, 253 (38%) were female while 405 (62%) were male. Other details of respective respondents are discussed in the following respective sections.

4.2.1 Head teachers

A total of 70 head teachers responded to a semi structured questionnaire; 44 (or 63%) of them were male while 26 (or 37%) were female. The study sought to establish their experience as heads of their schools. This was important because the ICT resources are a relatively new development in education and level of adoption of ICT is often determined by the experience of the instructional leader (Dawson & Rake, 2003). On how long they had been principals of schools therefore, their experiences are as indicated in Table 4.3.

Table 4. 3

Leadership Experience and Training of the Head teachers

Duration as head teacher (years)	**Whether trained in computer use**		**Total**	
	Yes	No	**F**	**(%)**
1-4	25	10	35	50
5-8	17	7	24	34.3
More than 8 years	9	2	11	15.7
Total	**51**	**19**	**70**	**100**

Table 4.3 indicated that half (50%) of the head teachers had served for less than four years, while the other half had served for either 5-8 years or more than 8 years (34% and 16% respectively). Those who have been in their schools longer than five years (50%) may have possibly been involved in procuring and receiving the ICT infrastructure from the ministry under the ESP. The Table 4.3 also indicated that majority of the teachers 51 (73%) had been trained in computer use while the rest had not. This may mean that almost a third of the head teachers had inadequate orientation in computer adoption. This is likely to have a negative influence in adoption of computer technology in school since the head teachers are the main change agent in their schools. If not trained, they could easily obstruct prioritization of computer adoption. On the contrary, those trained tend to create an enabling environment to advance use of computer technology in their schools, as has been advanced by Dawson and Rake (2003). This may therefore not happen if the instructional leader is not computer literate.

4.2.2. Teachers

The teacher respondents were 251, which was 72 % of teachers targeted. Among these, 184 (73%) were male while 67 (27%) were female. The teachers profile was critical on two grounds. First it indicated the kind of the respondents and secondly it indicated the demographic characteristics to be statistically controlled. A cross tabulation of teachers teaching experience and their average age in years computed showed that a good number of teachers (55 or 36%) were less than 30 years of age. As was expected, all the teachers in this category had a teaching experience of up to six (6) years. Similarly, teachers above 40 years of age were 61 in total (or 24 %), most of whom (58) had taught for more than 10 years. Figure 3 has the responses on teaching experience of teachers by their age brackets.

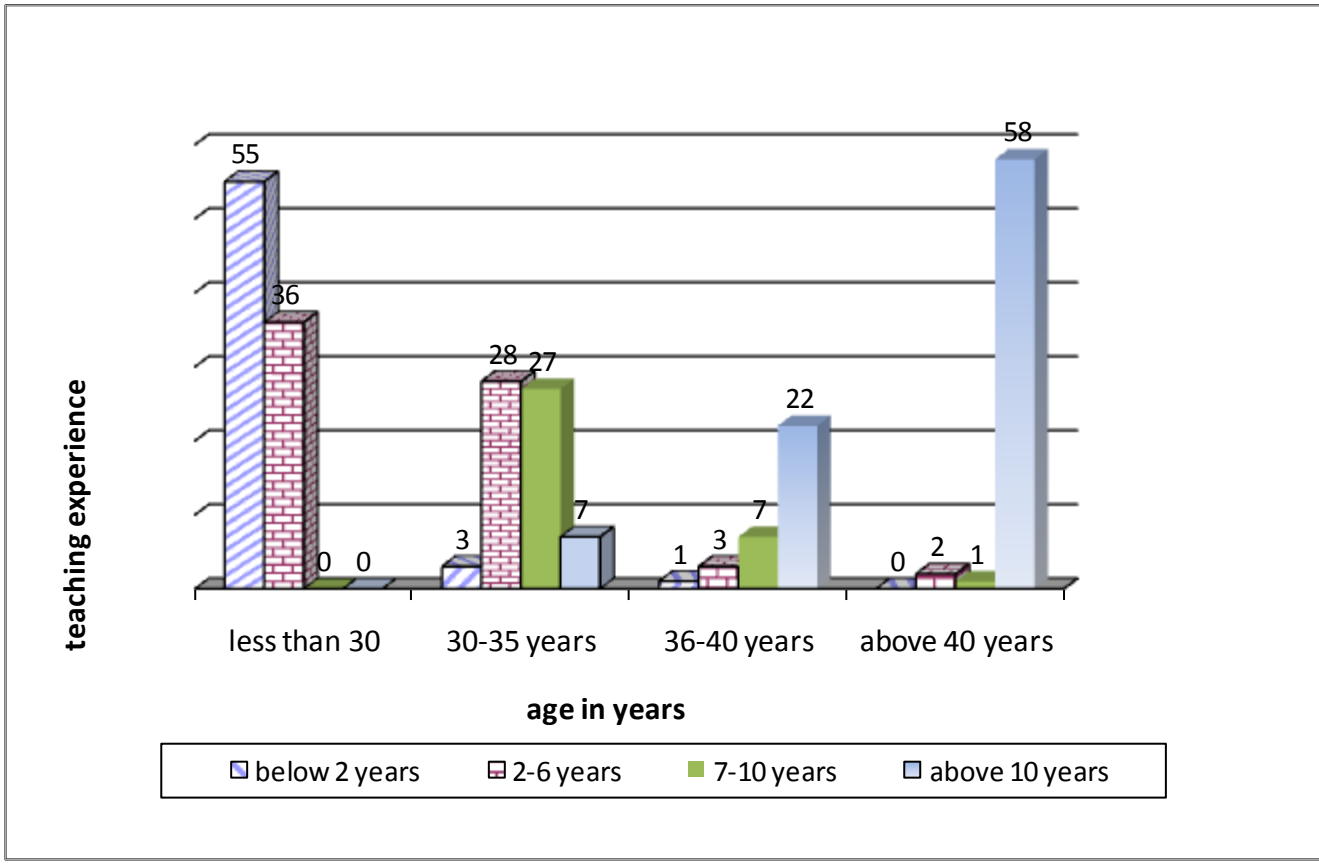


Figure 3. **Cross Tabulation of Teachers' Age and Teaching Experience**

According to Figure 3, the total number of teachers below 35 years was 156 (61.2%). A half of teachers, (128, or 51 %) had a teaching experience of less than six (6) years. This group therefore has been teaching since the ESP in secondary schools began in 2009. The rest (123 or 49%) had a teaching experience of more than six years and therefore had an experience of teaching before, during and after the ESP- ICT component was introduced. They therefore were well grounded and could possibly differentiate between traditional and constructivist methods of teaching. Constructivist methods of teaching were part of the training provided to teachers in the training for ESP. These are learner

centred teaching methods that are emphasized for preparing learners for the 21st century skills.

It would have been expected that teachers with a longer teaching experience have an equally longer duration and experiences with computer usage. The following Figure 4 showed a cross tabulation of teachers responses on their teaching experience by duration of computer use.

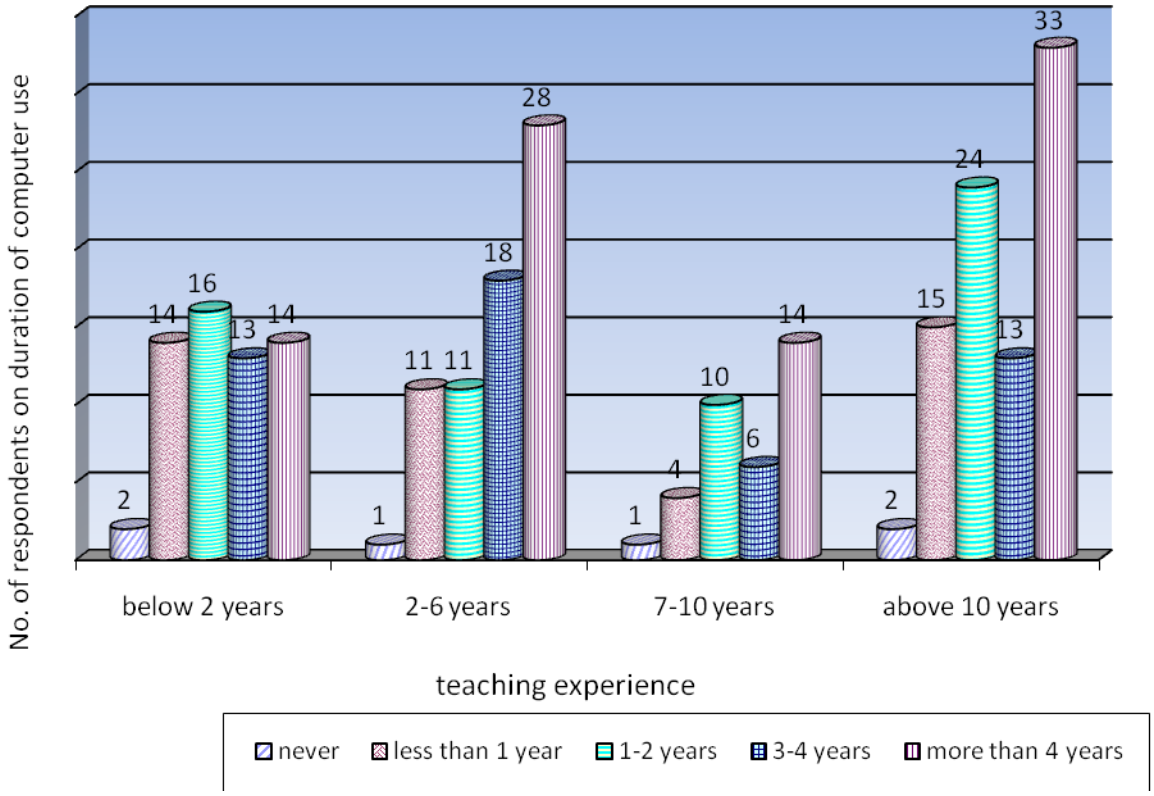


Figure 4: **Cross Tabulation of Teaching Experience by Duration of Computer Use**

The Figure 4 indicated that at every age bracket, there were teachers who had never used the computer technology or had used it for less than one year. These two groups had a total of 50 (20%) teachers. More than half of the teachers had a duration of three

years and above in computer usage (140 or 55.7 %). This was irrespective of their teaching experiences.

According to the Figure 4, the teachers with a longer duration of computer use were mainly within the 'above 10 years of experience' bracket (87, or 35%) and the '2-6 years experience' bracket (69, or 27 %). The group that had the least number of years in duration of computer use (35 or 21%) was the group with a teaching experience of 'between 7-10 years'. This was not necessarily the group with the lowest experience in teaching, of 'below two years', whose responses (59 or 24%) indicated a more favorable duration of computer use despite of having the least experience in teaching.

Teaching experience therefore was not equivalent to duration or experience in computer use. This is consistent with (Selwyn, 2003) who postulated that provision of ICT resources does not lead to automatic adoption or significant impact in education.

4.2.3. Learners

Out of 337 learners, 177 (54%) were male while 160 (46%) were female. These were selected from forms 2-4 classes as the Table 4.4 shows.

Table 4. 4

Learners' Classes

Class	F	(%)
Form 2	105	32.0
Form 3	136	41.5
Form 4	87	26.5

N= 337

Most (41.5%) students who participated were in Form 3 class. The Form Four classes were not easily accessible, possibly due to the fact that this was an examination class. Form One classes were considered relatively new in the school and may not have adequately interacted with the ICT infrastructure in the schools. Information seeking to find out if the learners had access to computers in the school is shown in Figure 5 according to their classes.

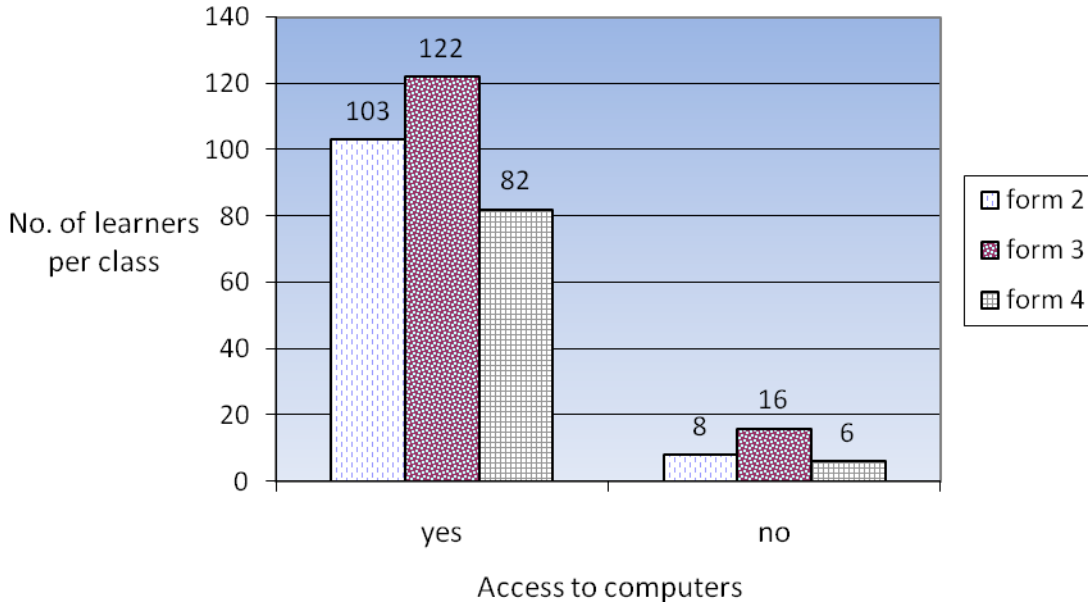


Figure 5. **Learners' Access to Computer in the School According to Class**

According to Figure 5, it seemed that majority of the students (307 or 91%) had access to the computers in the school. The Figure 5 also shows that those who did not access computer technology in the school were very few (30 or 9%), and may not necessarily mean that they had never had access to computers, probably out of school. The learners with access to the school computers were mainly from the Form 2 and Form 3 classes.

Form 4 had the least access; possibly because they were an examination class and were considered ‘too busy’ too interact with new innovations in the school.

4.2.4 Ministry officials

The researcher further reached four officers from different departments of the Ministry of Education. Officers from KICD, ICT4Development in the Ministry and KEMI were interviewed. Out of the four, three were female and one was male. They had all served for more than five years in their current designations.

4.3 Extent to which Computer Technology had been adopted in ESP schools

The ESP schools received a set of ICT infrastructure that included 11 computers, a laptop, an LCD projector and digital content from the Ministry of Education. This was irrespective of whether or not they previously had the infrastructure. Having acquired ICT resources, the first objective sought to establish the extent to which the computer technology was adopted in the school. Adoption was explained by variables such as duration of computer use, competence as indicated by experience of computer use, access, usage and frequency of usage, and teachers’ attitude.

4.3.1 Duration of computer use

To establish the teachers’ experiences using the computers the teachers were asked for the duration of their computer use in years. Their responses are shown in Figure 6.

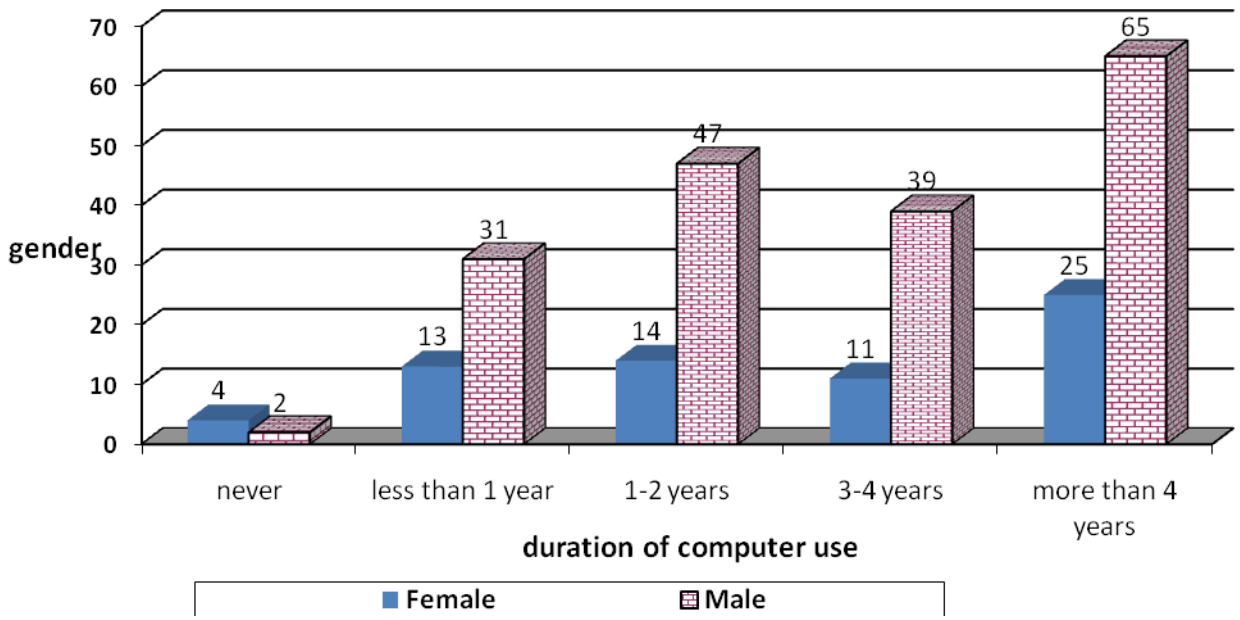


***Figure 6*: Cross tabulation of Teachers Duration of Computer Use by Gender**

In Figure 6, only 90 (36%) of the teachers had interacted with computers for a period of more than four years. More than half of the teachers, (155, or 61.7%) reported that they had an experience of using computers for less than four (4) years. Six teachers representing 2.4% said that they have never used computers. Although the ESP has been ongoing since 2009, it seems like most teachers started using the computers when the programme began.

4.3.2 Perceived Competencies

Teachers' level of competence was also an indicator of adoption. Teachers' competence plays a significant role in determining adoption of ICT in schools. Competence of teachers depends a lot on specific circumstance in their school (Tella et al., 2007). The study therefore also sought to find out teachers' level of competence in computer use. Figure 7 illustrates their responses.

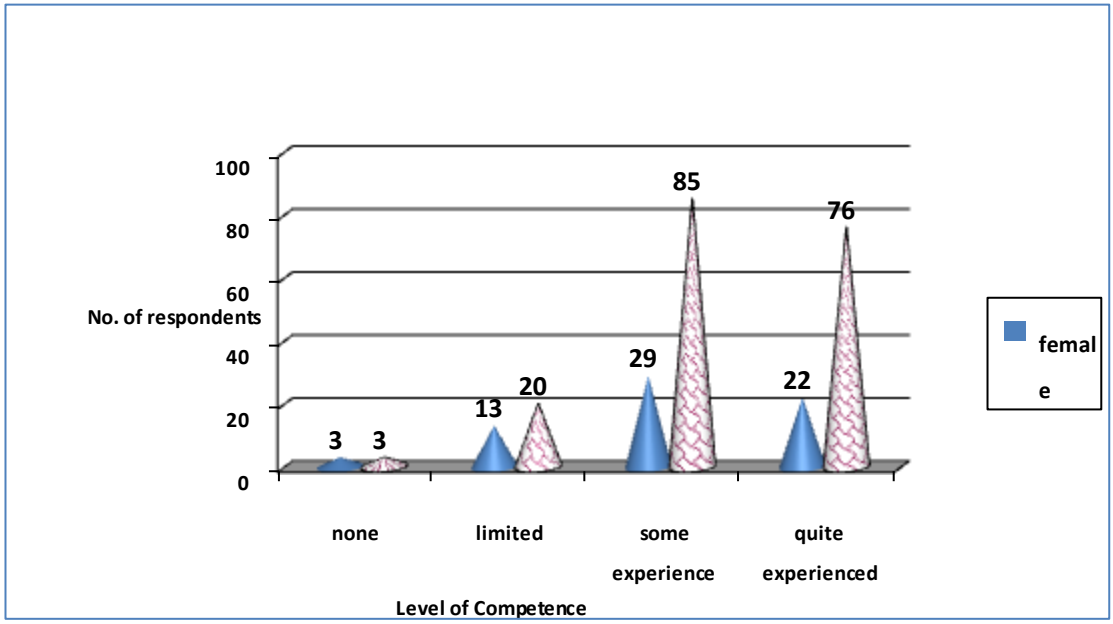


Figure 7: **Cross tabulation of Teacher Competence in Computer Usage by Gender**

The responses on competence according to gender are shown in Figure 7 which showed that the competence of the teachers varied. Most of them had 'some experience' 114 (45%) while a further 98 of them (39%) said that they were 'quite experienced'. Although the study reached more male than female teachers, the figure shows that the number of male teachers that 'had some experience' (85 or 34 %) or those that were 'quite experienced' (76 or 30%) in the use of computers was much higher that female teachers in the same category who were 29 (12 %) and 22 (9 %) respectively. Only a few (3 or 2.4%) of the teachers said they were not competent. This was the same number that earlier indicated not having used computers at all (Figure 3). This finding showed that many teachers had high self perceived levels of competence. It also showed that with such a large number of competences among them (45.4% with 'some competence' and 39% who were 'quite competent'), teachers can

adopt ICT if contextual factors in their schools are suitable and supportive. This finding corroborates a discussion given by ISTE (2002) in Nicolle (2005). It emphasizes that to cater for learning in the 21st century, and for learners to become technologically proficient members of this technological age, they should be educated by teachers who have competently adopted technology. With this regard therefore, only 39% can confidently teach using computers and raise proficiency of their learners. On the other extreme, the incompetence of a portion of teachers, (2.4%) impedes realization of ICT related goals.

This finding further agrees with Rogers (1995) theory of diffusion which describes teachers' attitudes and competence with technology being among key factors associated with their adoption. Although the study did not inquire further on the details of the 'quite competent' teachers, Gachoka (2012) is of the opinion that these competent teachers should be able to evaluate and use computers and relate ICT tools for instruction, and apply instructional principles and appropriate practices to the use of ICT. On teachers' competence, Pelgrum (2001) confirms that lack of competence is a main impediment to realization of ICT related goals.

4.3.3 Access to ICT resources

Access to ICT resources in school provides opportunities for its use in teaching and learning. The ICT resources as observed in ESP schools include desktop computers, laptop, printer, internet, DVD player and LCD projector.

The teachers were asked whether the ICT resources were accessible to them as well as the learners. Teachers' responses on access of computers are shown in Table 4.5

Table 4. 5

Teachers and Learners Access of ICT Resources

Resources	Teachers access				Learners access			
	Yes		No		Yes		No	
	F	(%)	F	(%)	F	(%)	F	(%)
Desktop computer	237	96	10	4	187	76	60	24
Laptop	180	73	67	27	30	12	217	88
Printer	215	87	32	13	76	32	171	69
Internet	174	70	73	30	94	38	153	62
DVD player	153	62	94	38	107	43	140	57
LCD projector	50	20	197	79	26	11	221	89

N=251

According to Table 4.5, all the ICT resources were accessible to majority of the teachers but at varying degrees. Desktop computers and printers are the most easily accessible resources by almost all the teachers at 96% and 87% respectively. More than half of the teachers (76%) reported that the learners too had access to desk top computers more than any other ICT resource in the school. Access to the other resources was above average among teachers except for the LCD projector. The LCD projector was the least accessed resource by both teachers and learners at 20% and 11% respectively.

Access to other resources among learners was below average as indicated by the teachers' responses. If teachers may have had a challenge in accessing the infrastructure, then the scenario was worse for learners. Access may have been hampered by the few resources in relation to the number of teachers and learners in each school. Except for the desktop computers, all these other resources existed in minimal numbers, mostly as only one.

Access to ICT resources is not only important for teachers but for learners as well. The learners, being in ESP secondary schools, were expected to have had access to the computers since the resources were available. Asked if they had access to computers, majority (91.8%) affirmed that they had, while only 8.2% had not had access to the computers. They were further asked the ICT resources they had access to. Table 4.6 shows that learners mostly access the ICT resources in their school.

Table 4. 6

Access to ICT Resources by Teachers and Learners

Resources	In school		Out of school		No access at all	
	F	(%)	F	(%)	F	(%)
Desktop computer	268	79	16	5	53	16
Laptop	102	30	137	41	94	28
Printer	180	53	39	12	117	35
LCD projector	202	56	19	6	115	35
Internet	128	39	108	32	96	29

N=337

The resource most accessed by the learners within the school is the desk top computer followed by the LCD projector as indicated by 79 % and 56% of the learners respectively. This corroborates what the teachers earlier, that learners mostly access desk top computers as compared to any other ICT resources. Least accessed by learners in the school is the laptop which elicited a response rate of 30%. This is probably because schools were only provided with only one lap top which is mostly used by the teachers. Some (56%) teachers however contradicted themselves when they said that they had access to the LCD which in most cases accompanies the laptop.

A few teachers responses earlier (11%) that indicated that the LCD projector was only accessible to a few learners, showed a discrepancy from responses elicited from their learners, where 56% of these learners indicated they had access to the LCD projectors within the school.

Worth noting is that many learners accessed ICT resources while away from school, possibly at home or in cyber cafes as the Table 4.7 shows for computers (41%) and internet (32%). Further still, a substantial number of them had no access at all to any of the resources. This finding is an indication that number of learners' access to computers is relatively high and they are able to access information whether at school, home or in the communities they come from.

A further analysis was done to show responses on number of resources that teachers and learners on average could access. The means generated showed that teachers had access to more resources than the learners. This is important since teachers are the drivers of ICT adoption in schools. The means from the respondents gave the following output;

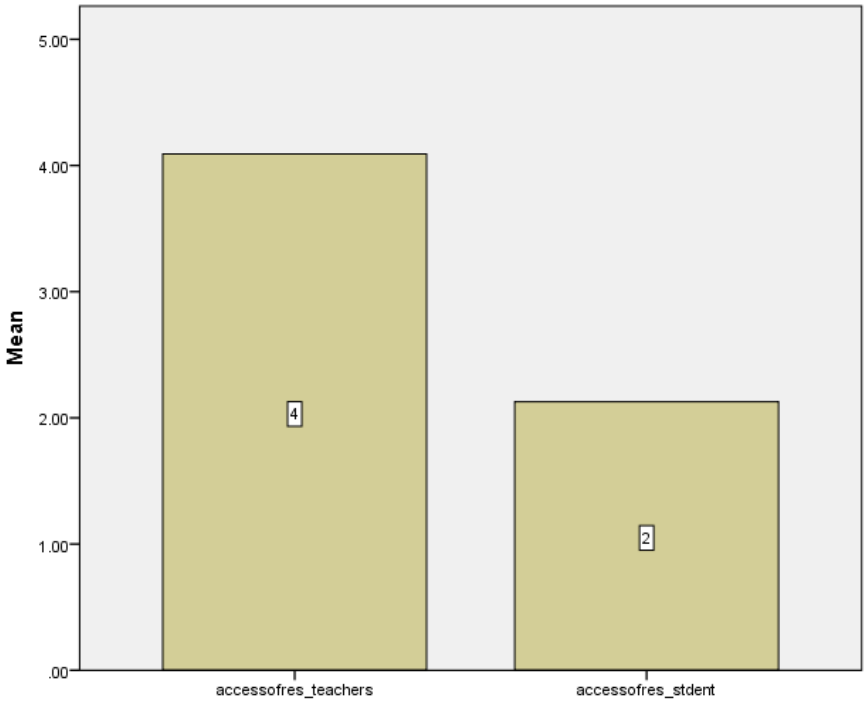


Figure 8. **Means of Resources Accessed by Teachers and Learners**

Out of the six (6) types of resources available in schools, the access on average was four and two for teachers and learners respectively. Ideally all teachers should access all the resources for integration. The low access to ICT resources by learners in schools as indicated by the low mean (2) shows that schools may not be providing the opportunities for them to use the technology resources. This affects their motivation in learning and experiences with ICT. Moyle (2010) opines that learners are today exposed to technology rich environment especially out of school and are becoming more adept at using technology than their teachers. In addition, Mumtaz (2000) clearly points out that

level of access to ICT are significant in determining levels of use. It would therefore be unfortunate to deny access to learners who are ready to experiment with technology.

Although the computers and ICT resources in schools are located in a computer room, there were various locations where they have been stationed, either for instructional or administrative functions. Further analysis showed that although the ICT resources were secured in the computer rooms, other locations for accessing computer were identified. The teachers were asked to indicate the location where they accessed the resources. Responses to this effect indicated that access of the ICT resources was mainly (90%) in the computer rooms. This is reflected in Table 4.7.

Table 4. 7

Location of Computers Access by the Teachers

Location of the ICT resources		
	F	(%)
Staff room	56	23
HoDs/teachers office	33	29
Principals office	55	22
Classroom	19	8
Computer room	222	90
Library	28	11

N=251

According to Table 4.7, the ICT resources are located in the computer room as indicated by majority (90%) of the teachers. Very few (8%) of the responses indicated that computers are located in classrooms, yet this is where most teaching and learning takes place. Tondeur et al. (2007) have urged that use of computer room is a deterrent in itself to access and use because it is a physical separation of computers from the users. However the circumstances in the ESP schools dictate that the computer resources be

kept in secured rooms away from classrooms and used under the teacher's supervision. It can only be hoped that these have not made the ICT resources to remain unreachable resources for a few people.

Other areas where computers are located included the head teachers' office, as cited by 22% of the teachers. This may imply that they are used for administrative work such as registration and school records, possibly by the school secretary. Those located in the staffroom (23%), HoDs offices (29%) and library (11%) were possibly used by the teachers for their own preparation, analyzing student performance in examination and timetabling. Mwaura (2011) in his study made similar observations. Various locations of the ICT resources shows that for some of the teachers there was a wider choice of where to access computers, and may imply that they have no excuse of not adopting computer especially for instructional use.

This finding on access and location of computers agrees with Kavagi, (2010) who observed that the way computers are stored and accessed directly determine how much they will be used. It was therefore important to conclude that majority of teachers and learners had access to the computer technology. This is essential if adoption of ICT is to become a reality in teaching and learning in schools.

Just like the teachers, the learners mostly accessed the computers and other resources from the computer room, otherwise known as computer lab. When asked the area from which they accessed the computers, their responses showed the following findings in Table 4.8.

Table 4. 8

Learners' Areas of access to Computers in the school

Area of access	F	(%)
Computer rooms	293	87
Classroom	9	3
Library	5	2
Others (no access)	30	8
Total	337	100

Findings shown in Table 4.8 confirm responses from the teachers on location of ICT infrastructure in the school. Majority (87%) of the learners indicated that computers are accessed in the computer room and in very few instance within the library (2%) or classrooms (3%). As long as the computer rooms are kept under 'lock and key' for security reasons, this limits users access and thereby denying them opportunities for creativity or innovativeness in the school. After all, these resources are readily available in some homes and in the community and as Gacoka (2011) observed, learners with access to computer technology are active participants in the learning process producing knowledge and learning collaborations. It would be more prudent to have more access to ICT resources in the school.

4.3.4 Uses of Computer Technology by Teachers and Learners

To be able to expound on adoption, different uses of computer technology were sought. It was clear that computer technology in schools is used for instruction and administrative purposes as indicated by information sought from the teachers and the head teachers on how they used computer technology in their schools. Table 4.9 shows their responses;

Table 4. 9

Uses of Computer Technology in Schools

Uses of Computers Technology	Teachers				Head teachers			
	Yes		No		Yes		No	
	F	(%)	F	(%)	F	(%)	F	(%)
1. Teachers learn basic skills	191	76	60	24	53	76	17	24
2. Students learn basic skills	175	90	76	30	46	66	24	34
3. Instructional use	160	64	91	36	54	77	16	23
4. Keeping records	217	86	34	14	50	71	20	29
5. Sourcing for information	212	84	39	16	54	77	16	23
6. Communication	61	24	190	76	6	9	64	91

Teachers N= 251 Head teachers N=70

Table 4.9 shows that respondents gave multiple responses. All the uses indicated were rated above average by the teachers apart from communication which was rated at 24%. Teaching students basic skills (90%), Keeping records (86%) and sourcing for information (84%) were the highest rated responses among the teachers. The head teachers too rated low the use of ICT for communication (9%); they rated high use of ICT for instruction (77%) and sourcing for information at (77%).

The head teachers were asked for additional uses of ICT resources. They indicated other uses such as registering exams, preparing time tables and for student entertainment and recreation as other additional uses. The main difference made by the additional infrastructure was in administrative functions such as storage of information, registering students for examinations, fee records, and time tabling, setting and processing of information. They also mentioned that there was an improvement in learning basic skills by both teachers and learners, thereby raising levels of computer skills. Use of internet had made it easy to source for information and conduct research.

The head teachers who cited instructional purposes said that teachers used the computers for timetabling, preparing schemes of work, lesson preparation, e-learning and teaching computer studies for Form One and Two classes. A few schools that had used them for teaching and learning reported that learning was more interesting and participatory. Some head teachers were very categorical, and cited inadequate or low usage despite having the computers. This observation was also made during data collection as a few schools had not even unpacked the ICT resources received from the Ministry. They were still awaiting completion and securing of the computer rooms.

In order to corroborate information on usage from the teachers, the study sought to find out from the learners the subjects in which teachers mostly used computers for instruction. Their responses indicating whether or not teachers used ICT in the classroom were indicated as shown in Table 4.10.

Table 4. 10
Learners' Rating of Computers Use by Teachers

	Yes		No	
Subject	**F**	**(%)**	**F**	**(%)**
Mathematics	34	10	298	90
Biology	90	27	242	73
Chemistry	52	16	280	84
Physics	68	21	264	80
Computer studies	115	47	177	53
Business studies	27	8	305	92
Geography	37	11	295	89
History	19	6	313	94
Agriculture	15	5	317	95
Home science	5	2	323	98
Kiswahili	24	7	308	93
English	32	10	300	90

N=332

According to Table 4.10, it was clear that many learners were not exposed to learning through or with computers across subjects. The subject which learners cited most as using computers was Computer Studies (47%) followed by Biology (27%) and Physics (21%). Information provided by KICD officers indicated that the Institute had developed digital content for Forms 1, 2, 3 and 4 in all learning areas. In addition, part of the package given to ESP schools for ICT included digital content for Form One. This was to encourage integration of ICT in teaching and learning (KICD, 2013). Despite of the availability of digital content therefore, learners' responses show a low use of the computers in curriculum delivery.

The responses from learners differed from that of head teachers who mentioned that computers were used for e-learning and Computer Studies. It was clear that apart from the Computer Studies subject cited by 47% of learners, there was hardly any use of computer technology in the other subjects. This finding agrees with studies done by Wanjala (2010) who cited low use computers in Mathematics; and Nengo (2012) in

general secondary school curriculum. This low use may be attributed to teachers' inadequate competence and access, as well as pedagogical beliefs inclined to teacher centred classrooms. This finding was confirmed by Ertmer (2005) who opines that in many instances, low level of computer use has been associated with teacher centred or traditional classrooms and that teachers in such classrooms are less likely to take up adoption of computers.

This study concurs with KICD (2013) where utilization levels reported across all classes were below 50%. The KICD study (ibid) noted that only Computer Studies (47%) and the science subjects, such as Biology (27%), Physics (21%), and Chemistry (16%), showed a considerable effort in using digital content as compared to all other subjects. This was probably because the Computer Studies is undertaken by many students in ESP schools as an examinable subject while the science subjects have teachers who have been involved in SMASE programmes that have integrated technology in their training (MoE, 2013).

Additional information provided by the MoEST officers on uses of the ICT resources in schools concurs with what the other respondents from the ESP schools gave, such as, administrative use, communication, teaching and learning basic skills, sourcing for information and for curriculum delivery. Further, the officers were asked what their departments or institutions had done to ensure the resources were used for the intended purposes as had been envisaged. Their responses indicated that they have worked collaboratively to sensitize, orientate and train teachers on using digital content and on integration of ICT in teaching and learning. Other activities that they have engaged in include developing digital content, curriculum for training teachers on integration and

training manuals to assist in training the teachers, they have also monitored the purchasing of the procured resources as well as the implementation of digital content provided to schools. This finding agrees with what Scheuermann and Pedro, (2009) referred to as a wide spectrum covered with thematic and along administrative axis. Kozma (2008) too has also referred to the diverse fields that include curricula and pedagogical approaches being changed to cater for educational change with ICT as well as content development to facilitate the interactive potential ICT can offer in the teaching and learning process.

The adequacy of the ICT resources provided to ESP schools was discussed with the Ministry officials. They expressed awareness that although the eleven (11) computers or twenty two (22) in some cases may not be adequate, the emphasis for adoption was to integrate the available resource irrespective of numbers. The schools have been encouraged to acquire more resources as well as become innovative with the resources available. Literature reviewed on adequacy reveals that this has been a major reason for slow adoption, but the emphasis of the Ministry is innovativeness with the computers within the school and not necessarily large number of computers (MoE, 2013). Although the ministry of Education has made efforts to provide resources, the aspect of monitoring and evaluation does not seem to be a priority. The study established that only monitoring of the procurement of the ICT infrastructure and the utilization of digital content in ESP schools had been conducted since inception of the programme in 2009. Probably, there is no formal structure for monitoring of the ICT component in ESP schools. This affected the rate of adoption of computer technology as there seem to be no follow up, and if there is it is irregular and inconsistent.

4.3.5 Frequency of Using Computers

Apart from teaching and learning though the computers in various subjects in school, using the computers for other tasks bring about meaningful adoption among teachers and the students. Frequent interaction with the ICT resources enables users to gain knowledge, skills and attitudes in adoption of ICT. To further determine extent of adoption, the study sought to establish from the respondents the frequency with which they were using the computers for various tasks. The frequencies and percentages with which teachers used computer technology in the school for different tasks are presented in Table 4.11.

Table 4. 11

Frequency of teachers using Computer Technology

Resource	**Often**		**Sometimes**		**Rarely**		**Never**		
	F	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**N**
Teaching subject	30	14.6	42	20.5	81	39.5	52	25.4	205
Online search	41	20.7	56	28.3	76	38.4	25	12.6	198
Power points	16	9.6	38	22.8	72	43.1	41	24.6	167
Schemes of work	58	24.4	57	27.9	50	24.5	39	19.1	204
Progress record	77	38.5	44	20.5	65	30.2	29	3.5	215
Comm. -learners	17	14.5	22	18.8	30	25.6	48	41	117
Comm. -parents	11	11.8	10	10.8	16	17.2	56	60.2	93
Comm. -admin	16	13.7	21	17.9	26	22.2	54	46.2	117
Handouts	36	5.5	32	17.4	75	40.8	41	22.3	184
Learn skill	79	37.7	50	23.3	51	23.7	35	16.3	215
Teach learners	52	28.4	37	20.2	49	26.8	45	24.6	183

*comm. =communication
N=251.

Max scale=5. Responses ranged from ‘very often’=5, ‘often’=4, ‘no opinion’=3, ‘rarely’=2‘and ‘never’ =1’

Table 4.11 shows that the computers were used most frequently by teachers for keeping records (38.5) and learning basic skills (37.7%). The computers were least used for communication by most teachers with 14.5%, 11.8% and 13.7% for communication with students, parents and administration, respectively.

4.3.6 Teachers Attitudes on Influence of Computer Technology in Teaching

Extent to which computer technology had been adopted was finally explained by the teachers' attitudes on influence of ICT to their teaching. The teachers' attitudes determine whether or not they will adopt any innovation (Gess – Newsome et al, 2003; Groff and Mouza, 2008). A likert scale was used to find out teachers' opinions on influence of computer technology in their teaching. The findings are illustrated in Table 4.12.

Table 4. 12

Attitudes on Influences of Computer Technology in Teaching

	Mean	Std. Deviation
1. ICT helps me provide more effective instruction	4.10	.90
2. ICT gives me a lot more work	2.66	1.22
3. ICT doesn't add value to my teaching	1.84	1.05
4. ICT allows me more insight into students performance	3.92	.86
5. ICT helps me to facilitate learning through small group work	3.63	1.08
6. ICT helps me develop students to become better problem solvers	3.87	.87
7. ICT allows teachers more time to help individual students	3.72	2.78
8. ICT helps me communicate more effectively	2.78	1.60
9. ICT make it easier to collaborate with colleagues	3.96	.91
10. I don't need ICT to understand how my students are doing	2.27	1.26
11. ICT provides a wide range of resources to teacher	4.32	.96
12. Training focused on technology in my subject area	3.35	1.26
13. Training has guided me on integration in my subject area	3.65	1.18
14. Training showed me to use technology to make teaching effective	3.83	1.12
15. Am able to use technology in my subject	3.88	1.09
16. I give students access to ICT resources for learning	3.31	1.24
17. Students are more attentive when using ICT in teaching	3.92	1.08
18. Students are more motivated to learn when I share a computer with them during learning	3.92	1.09
19. Students understand subject matter more deeply when I use ICT for instruction	3.83	1.03
20. I depend more on conventional mode of teaching rather than use technology	3.18	1.27
21. I use email to provide computer access to provide access for learners to work in small groups	2.16	.99
22. I provide notes or assignments for my class during lesson using email	2.32	1.08
23. Am very keen in using computer technology in instruction	3.69	1.15
24. There has been a change in my instructional methods since ESP began	3.52	1.16

N= 251. Max scale =5. Responses ranged from 'strongly agreed=5, 'agreed=4, 'no opinion'=3, 'disagree =2 'and 'strongly disagreed=1'.

Majority of teachers ‘agreed’ or ‘strongly agreed’ with statements provided as indicated by the high means out of a maximum of 5 in Table 4.12. There was more influence on ‘ICT provided a wide range of resources to the teacher’ (M=4.32, SD =.96) and ‘ICT helps me provide more effective instruction’ (M=4.10, SD= .90). Means of above between 2.5 to 4 as indicated for majority of the other statements may imply a moderate influence. Statements with the lowest ratings were ICT doesn’t add value to my teaching ‘(M=1.84, SD=1.05); ‘I don’t need ICT to understand how well my students are doing (M=2.27, SD=1.26); ‘I use email to provide computer access to provide access for learners to work in small groups’ (M=2.16, SD=.99); and ‘I provide notes or assignments for my class during lesson using email’ (M=2.32, SD=1.08). These statements with low rating may have been perceived to have a lower influence on the teachers. Further, majority of them ‘agreed’ or ‘strongly agreed’ with the statements that positively expressed their opinions on how ICT influences their teaching, while many ‘disagreed’ or ‘strongly disagreed’ with statements that are negative, hence the low mean ratings. Generally teachers were positive in as far as influence of computer technology in teaching was concerned.

Since the items had a high loading of 24 factors, factor analysis was conducted to categorize similar constructs on teachers’ attitudes on how computer technology influences them. Communalities varied from .703 to .077. A Scree test indicated 3 factors as shown in the following rotated component matrix;

Rotated Component Matrix[a]

How Computers Influence Teaching	1	2	3
1. ICT helps me provide more effective instruction		.657	
2. ICT gives me a lot more work			
3. ICT does not add value to my teaching			
4. ICT allows me more insight into students performance		.639	
5. ICT helps me to facilitate learning through small group work		.647	
6. ICT helps me develop students who become problem solvers		.726	
7. ICT allows teachers more time to help individual learners			
8. ICT helps me communicate more effectively			
9. ICT make it easier to collaborate with colleagues		.609	
10. I do not need ICT to understand how well students are doing			
11. ICT provides a wide range of resources to teacher		.523	
12. Training focused on technology in subject area	.679		
13. Training has guided me on integration	.828		
14. Training showed me how to use technology to make teaching effective	.828		
15. Am able to use technology in my subject	.792		
16. I give students access to ICT resources	.628		
17. Students are more attentive when using ICT	.724		
18. Students are more motivated to learn when I share a computer with them	.685		
19. Students understand subject matter more deeply when I use ICT for instruction	.708		
20. I depend more on conventional mode of teaching rather than use technology			
21. I use email to provide computer access to the learners			.768
22. I provide notes or assignments for my class during lesson through email			.727
23. Am very keen in using computer technology	.482		
24. There has been a change in my instructional methods since ESP began	.652		

Extraction Method: Principal Component Analysis. Rotation Method: Va
Normalization. a. Rotation converged in 4 iterations.

The three rotated factors accounted for 45.8% of the covariance among variables. Following varimax rotation, factor one was loaded on 12 items that reflected on how teachers have been prepared to use ICT in their teaching. It accounted for 23.5% of the variance by the three highest loading items, i.e. *Training has guided me on integration; Training showed me how to use technology to make teaching effective and, am able to use technology in my subject.* The second factor was loaded on six items and accounted for 14.8% of the variance and was labeled how ICT helps teachers, while the third factor was loaded on three two items and had a variance of 7.6%. It was labeled communication through email. Six of the items were not factored, hence were dropped. From these findings, teachers had been prepared and trained to use computer technology; and therefore they regarded their training positively.

Teacher preparation for computer use is critical for adoption. The preparation entails training, which Fullan (2001) observed takes teachers out of their comfort zones as it sometimes creates anxiety and uncertainty. It was therefore not surprising to find that, teachers were able to use ICT for instructional purposes only to some extent. The mean for each three factor was computed for further analysis that elicited a variable assigned as ‘teachers’ attitudes.

Additional information on the extent of adoption of computer technology in the ESP schools from MoEST officers’ interviews indicated that adoption of the ICTs is increasing due to provision of policy, digital content and capacity building. In their opinion, adoption depends on the perceived benefits by the individual teachers and even the school itself. This concurs with theories on adult learning (Knowles, 2005), and that

on adoption (Rogers, 2003), which advanced that individuals adopt to change depends on whether they value the new approach. Such approaches include opportunities of advancing skills, for promotion, or enhancing curriculum delivery. The uptake of computer technology therefore seems low where there is lack of enthusiasm and training. Teachers probably need more convincing that the computer technology can be used to improve their performance as well as that of their learners.

4.4 Influence of Individual Characteristics on Adoption of Computer Technology

Individual characteristics refer to the uniqueness of teachers as individual. The teacher characteristics are variables such as their beliefs and demographic information that includes age, gender, experience, qualification, and training. These can hinder or enhance adoption of computer technology in schools. To be able to identify teacher characteristics, various aspects that define these characteristics were gathered from the teachers with regard to their demographic information and from other respondents regarding their opinions on teacher characteristics.

This study objective therefore sought to find out extent of teachers' characteristics in predicting adoption of computer technology. In order to do this, teacher characteristics were identified as the independent variables (IVs) and defined by teaching experience, duration while adoption was the dependent variable (DV). The DV was explained by summation of access, usage, frequency and teachers' attitudes. Multiple regression was performed which yielded the following results;

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.537[a]	.288	.276	5.93324

a. Predictors: (Constant), teaching experience, duration, competence, age

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	3502.957	4	875.739	24.877	.000[b]
	Residual	8660.017	246	35.203		
	Total	12162.974	250			

a. Dependent Variable: summation of access, usage, frequency and attitudes

b. Predictors: (Constant), teach experience, duration, competence, age

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations		
		B	Std. Error	Beta			Zero-order	Partial	Part
1	(Constant)	9.785	1.934		5.058	.000			
	duration	.975	.377	.167	2.585	.010	.387	.163	.139
	age	.449	.603	.077	.744	.458	-.069	.047	.040
	competence	3.829	.597	.416	6.418	.000	.514	.379	.345
	teach exp	-.793	.605	-.136	-1.311	.191	-.109	-.083	-.071

a. Dependent Variable: summation of access, usage, frequency and attitude

Multiple correlations R = .537 represent the combined correlation of the IVs. Adjusted R^2 showed that 28.8% can be explained by the variations in IVs taken together. This leaves 71.2% unexplained. The ANOVA analysis which was testing whether the model is significantly better at predicting the outcome than using the mean, showed the F value = 24.877, which was significant at $p<.000$. This showed that the four individual variables taken together as a set significantly related to the dependent variable.

The first research hypothesis was stated as;

H_0: there is no significant individual variable in prediction of adoption

Significant regression coefficients shown were duration of using computers at t= .010 and level of competence at t=.000. These significant variables make a unique contribution to prediction. The rest namely age and teaching experience were not significant.

Since there were two significant individual variables predicting adoption, the H_0 is rejected, and the alternative taken; **H_1; there were two significant individual variables in prediction of adoption as p<.05**

The following histogram and scatter diagrams show the homoscedasticity of the variables. The histogram shows the difference between the predicted and obtained variables was more or less normally distributed. Dispersion points in the scatter graph are linear. This is an indication that for this objective, the assumptions were met.

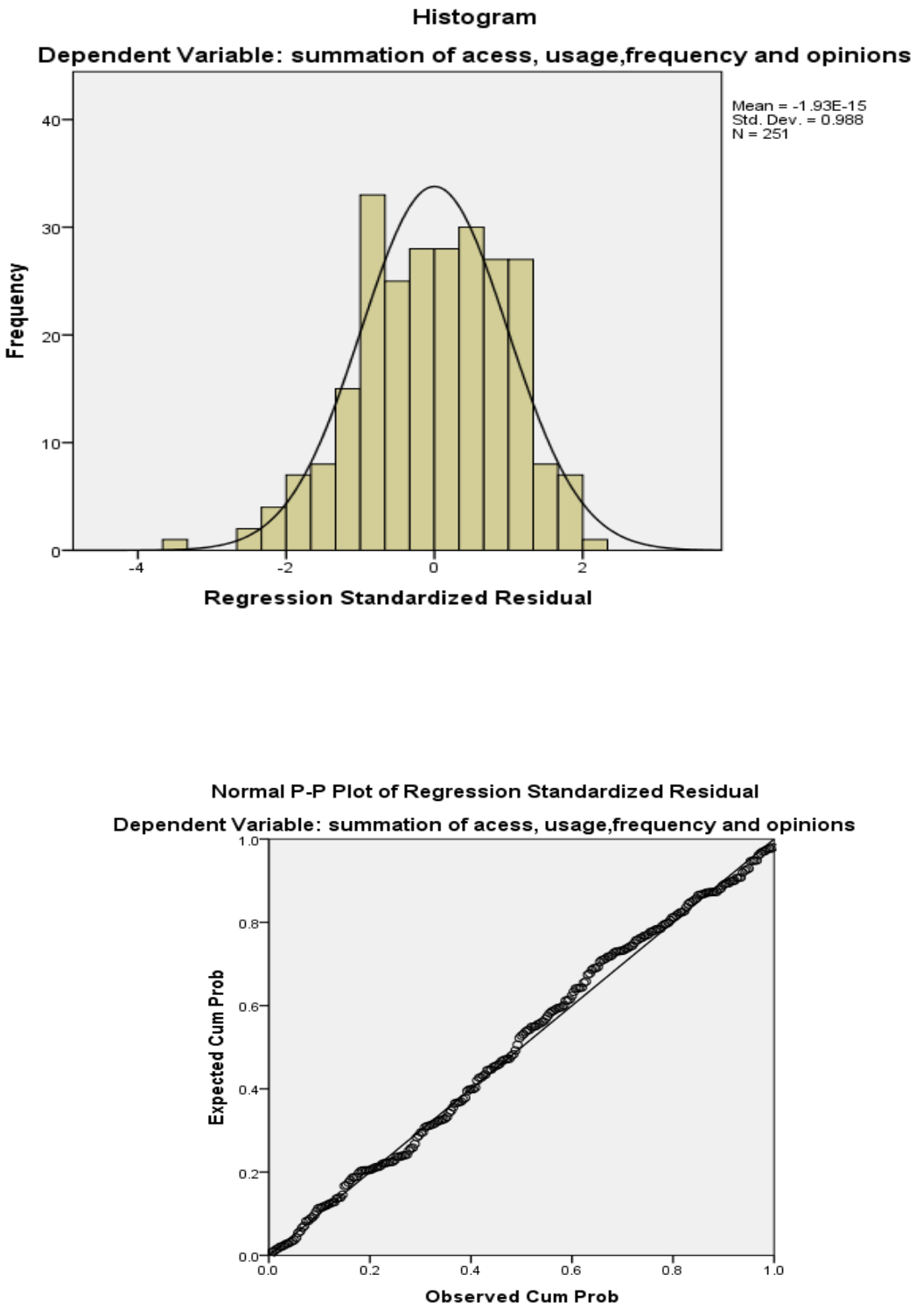


Figure 9. **Histogram and Graph of the Variables**

The significant IVs in individual characteristics that influence adoption therefore are experience in using computers and perceived level of competence. Although correlation was out of the scope of this study, long duration of use often result to competence. Brinkerhoff (2006) has observed that teachers require time after learning to use computers technology to capably support student learning. This allows them to be more knowledgeable and competent.

The aspect of competence is very useful if computer technology is to be well integrated in learning. It shows the capacity of teachers to adopt technology. The Sessional Paper No.12 (MoE, 2013) stipulates that successful use and integration of ITs for education depends on key success factors such as; '…..teachers with ICT competencies and pedagogical abilities to integrate and use ICT resources are more effective in the delivery of the curriculum' (p. 56).

The Sessional Paper also acknowledges that ICT has not been embraced for instruction or as a management tool due to inadequate competence of teachers, hence teachers on a continuing basis should be equipped with the relevant ICT skills, knowledge and competencies for effective teaching and learning. From the interviews with Ministry of Education officials, teachers were sensitized and training in technology is increasingly becoming widespread. They indicated that interest in obtaining ICT skills among teachers and adaptability to change were some of the factors of teachers' characteristics enhancing adoption. On the other hand, the factors inhibiting adoption that they cited included lack of skills, negative attitude, technophobia, older teachers who are unwilling to change and low perceptions on importance of ICT in teaching. It was also

implied that teaching had become too examination oriented, hence inadequate time to spare for ICT.

Although, the officers were positive that a lot of efforts were made to build capacity of the teachers, they confirmed inadequacy of a consistent framework to monitor ESP schools activities in ICT adoption. This seems to be lacking in the schools under ESP from the macro (national) level down to the teachers (micro) level. Just like BECTA did for the United Kingdom in supporting technology innovation in schools (Gaffney, 2010), there should be a strong role played by ICT for Development (ICT4D) at the Ministry to comprehensively monitor progress made by ESP schools in ICT implementation plans. The ICT4D ought to ensure sustained changes and build up a critical mass for the required paradigm shift in adoption of technology in Kenyan schools. This has been expounded by the ecological theory which underpins this study. The interactions within and across each level should fast track the adoption of ICT. Policy organs at the Ministry of Education should advice the government as well as reach directly to schools (meso level), and consequently, impact on what the teacher does in the classroom.

Although subjects taught, age and teaching experience were not significant predictors of adoption as indicated in this finding, Roger (1995) and Schiller (2003) have implied that demographic information such as education level, age, gender, educational experience and experience with computers can influence adoption of an innovation. This study agreed with what Wanjala (2010) found on of teachers' technology adoption and acceptance. He observed these characteristics as determinants of technology adoption and acceptance.

In this study age was not a significant predictor of adoption. This contradicts some studies (Waugh, 2004; Kotrlik and Redmann, 2004) which indicate that the younger the teacher, the more likelihood that they will adopt computer technology, and the older the teacher the more resistant they become to adoption of technology.

4.4.1 Teachers Immediacy Behavior

The immediacy behavior of the teachers in the classroom either motivates or de-motivates learners. Immediacy behavior refers to gestures, eye contact and movements that teacher uses while teaching in class. The behavior of the teachers in the classroom was considered part of the teacher characteristics from the learner's perspective. The study sought to find out from the learners how their teachers' behavior motivates their learning through and with computers. This is because more often than not, learners interests and motivation depends on 'how' they are taught rather than 'what' they are taught.

Statements on immediacy behavior were provided in a likert scale for the learners to indicate extent to which they agreed with the statements concerning the teacher(s) who use computer technology in teaching. Responses are indicated in Table 4.13.

Table 4. 13

Learners Perceptions of Teachers Behavior in Class

	Mean	Std. Deviation
1. Sometime teacher rarely looks at us on the eye	2.56	1.32
2. Teacher uses non verbal communication	2.48	1.10
3. Teacher physical appearance attracts	3.32	1.35
4. A lot of teacher student interaction	3.73	1.22
5. Teacher uses a lot of gestures and dynamism	3.31	1.20
6. Teacher face expression encouraging	4.01	1.38
7. Teacher makes positive remarks	4.01	.98
8. Teacher has a friendly smile	3.73	1.11
9. Teacher r uses humor	3.32	1.13
10. Teacher does not move away from desk	4.15	.98
11. Class environment suitable for interaction	3.99	1.12

N= 337. Responses ranging from 1-5 corresponding to Strongly Disagree (SD) - Strongly Agree (SA) were used.

The means of learners' rating of their teachers behaviors are indicates in Table 4.13. The statement on teachers movement from the desk while teaching was rated highest with M=4.15, SD = .98, as majority of the learners did not agree with this statement. Computer usage is a practical subject and teaching while stationed at the teacher's desk would be very ineffective. A further breakdown of teachers' immediacy behavior is indicated in Table 4.14.

Table 4. 14

Influences of Teachers Immediacy Behavior on Computer use

Teachers Immediacy Behavior	SA (%)	A (%)	U (%)	D (%)	SD (%)
1. Sometime the teacher rarely looks at us on the eye when teaching	8	15	19	39	19
2. The teacher uses a lot of non verbal communication when teaching	5	13	27	36	19
3. The teachers physical appearance attracts us to the subject	22	29	19	15	14
4. There is a lot of interaction in the classroom during the lesson	32	33	18	10	8
5. The teachers uses a lot of gestures and dynamism while teaching	17	33	24	17	9
6. The teachers face expressions are encouraging for learning	33	37	21	6	2
7. The teacher makes positive remarks when answering our questions.	37	36	20	5	2
8. The teacher has a friendly smile when teaching	29	32	27	8	5
9. The teacher uses humor in the course of teaching	15	31	31	14	8
10. The teachers does not move away from his/her desk during the lesson	2	5	13	35	44
11. The classroom environment is suitable for teacher/ student interaction	42	31	15	8	4

The highest responses on teachers behavior was rated at 73% where learners agreed (31%) and strongly agreed (42%) with the statement on ‘classroom environment is suitable for teacher/learner interaction’ during a computer lesson. This was followed by ‘Teacher makes positive remarks when answering questions’ with 71% (37% and 36% for SA and A respectively).

The teacher’s language in the class refers to teacher making positive remarks as well as using humor and friendly smile. This attracts students and motivates them to learn when the teacher using ICT creates suitable environment. According to Mishra and Koehler (2006) and Groff and Mouza (2008), students’ attitudes and experiences with

technology and as an instructional tool are important determinants in the successful uptake of digital content by teachers. That was why learners' attitudes and experiences are influenced by the behavior of the teachers. Unknown to teachers often, their verbal and nonverbal behaviors are a potential predictor of adoption of computer technology during lessons as they teach. This is similar to the theory of ecological systems (Berk, 2000), which illustrates the interactions of species at the micro system. A teacher at the micro level interacts with 'species' such as learners and technology, among other resources, hence forming a system that enables learning to take place. It is the output of the teacher therefore at the micro level that affects the school outputs at the meso level, and eventually the society, which is the macro level.

This finding indicates that positive immediacy behaviors draw learners to a given innovation in the classroom. It also enhances learning and influence student motivation. Integration of ICT in learning has been known to motivate learners and apart from being drawn towards the technology, they gather more interest in the classroom teaching.

4.5 Influence of Context predictors on Adoption of Computer Technology

The school environment greatly influences the manner in which different ICT resources are used. It is the school context that dictates whether there is an enabling environment for adoption of ICT. The third objective of the study was to assess the influence of school context adoption of computer technology in management of teaching and learning in the ESP schools. School contextual characteristics refer to the factors in school environment such as administrative support, adequacy of infrastructure, teacher-student ratio, policies and training, among others.

4.5.1 Contextual Factors

The use of computer technology in education takes place within the school context. It was therefore necessary to find out extent to which the adoption of computers in teaching and learning is influenced by the contextual factors in the school environment. This information was sought from the teachers, learners and the head teachers as well as the Ministry of Education officers.

When asked for comments on factors in the school context that influence or hinder adoption of the computer technology within the school context during interviews, Ministry of Education officers said that factors enhancing adoption include the guidance of the national policy on integration, positive school leadership, availability of the infrastructure, techno savvy learners, capacity building opportunities on emerging technologies and the need to diversify teaching and learning.

On factors inhibiting adoption within the school context, some of the officers said that though available, the resources could be inadequate. They added that lack of technical support, irrelevant content sourced from the internet, lack of role models and inadequate opportunities for Continuing Professional Development (CPD) could be inhibiting adoption of computer technology.

The teachers were provided with a likert scale with statements on the factors in the school that were likely to influence adoption of computer technology. These statements regarded how ICT is used by both teachers and learners in school. In each statement, they indicated their opinions using an appropriate response that ranged from strongly disagree to strongly agree (SD-SA). Their responses are in Table 4.15.

Table 4. 15

Contextual Factors Influencing Adoption of Computer Technology

Statements on Contextual Factors	SD (%)	D (%)	NO (%)	A (%)	SA (%)
1. ICT gives students access to a wider range of learning content and resources	4	2	9	39	47
2. Students are more attentive when using ICT	5	6	7	50	32
3. ICT doesn't motivate students	43	36	8	8	5
4. ICT helps students become more active in the learning process	4	7	9	52	28
5. With ICT students become lazy	32	49	10	6	3
6. Students get disrupted from their main learning agenda	17	23	11	33	17
7. If you have a good library you don't need ICT	47	39	9	3	2
8. ICT doesn't add much value to students learning of subject matter	45	36	7	6	6
9. Students are more motivated to learn when I use ICT	7	9	8	41	39
10. Students understand subject matter more deeply when they use ICT	4	11	9	45	31
11. There are enough computers at the school for my use	8	30	5	56	21
12. I have been provided with training opportunity on using the computer	5	12	3	54	25
13. Adequate technical support is available at the school to assist when computer problems occur	11	28	9	36	16
14. I have access to school computers whenever I need to use them for teaching	8	14	7	39	32
15. Adequate support is available from the head teacher on integrating technology for instruction	5	12	9	49	26
16. I receive incentives from my school to explore or implement new technology innovations	26	41	10	19	4

N=251. Responses were rated as Strongly Disagree (SD)=1; Disagree(D)=2; No Opinion (NO)=3; Agree(A)=4; Strongly Agree (SA)=5

Table 4.15 illustrated responses of various school factors that possibly influenced the adoption of ICT. Most teachers affirmed by either 'agreeing' or 'strongly agreeing' with the statements as indicated by the scores that were above average (over 70%). The highest rated statement was *'ICT gives students access to a wider range of learning content and resources'* with 86% (A=39% and SA= 47%).

On the other hand teachers responses showed that most teachers disagreed (D and SD) with statements that were negative to ICT use such as *ICT doesn't motivate students (*79%), *With ICT students become lazy* (61%), *If you have a good library you don't need ICT* (86%) and *'ICT does not add much value to students learning subject matter'*(81%). This implies that the reverse is true for most teachers, as very few of the agreed with the statements. Sixty seven percent (67%) of the teachers did not agree with the statement on receiving incentives from their school to motivate them in uptake of computer technology. When teachers want to advance and develop professionally, it is necessary to recognize and reward their efforts. Only 23% of the teachers expressed that they received such incentives. Recognition of teachers' efforts can probably raise morale for adoption.

Since the items concerning contextual characteristics had a high loading of 16 items, factor analysis was conducted in order to condense them. Communalities varied from .782 to .292. The Scree test indicated four factors as shown in the rotated component matrix in Table 4.16.

Table 4. 16

Factor Analysis on Contextual Factors

Rotated Component Matrix[a]

Contextual Factors	Factors			
	1	2	3	4
1. ICT gives students access to wide resources		.685		
2. Studs are more attentive	.685			
3. ICT does not motivate students	.709			
4. ICT helps students be more active		.831		
5. With ICT students become lazy		.797		
6. ICT disrupt s students get from main learning agenda				.776
7. With a good library you do not need ICT		.687		
8. ICT does not add much value				.692
9. Students are more motivated to learn	.847			
10. Students understand subject matter more	.810			
11. There are enough computers at the school			.504	
12. I have been provided with training			.442	
13. Adequate technical support is available			.689	
14. I have access to school computers whenever			.732	
15. Adequate support is available from the head teachers			.767	
16. I receive incentives from my school to explore new innovations			.513	

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 5 iterations.

The four rotated factors accounted for 58% of the covariance among variables. Following varimax rotation, factor one was loaded on 4 items that reflected on *learner motivation*. It accounted for 18.5% of the variance by the two of the highest loading items, *i.e. learners are more motivated to learn and learners understand subject matter more.* The second factor was loaded on four items. It accounted for 16% of the variance and was labeled *ICT resource for learners*, while the third factor was loaded on six items and had a variance of 15.1%. It was labeled *administrative support for teachers*. The fourth factor accounted for 8.2% of the variance and had a loading of two factors which reflected on *value of ICT to learning*. The four factors were computed for further analysis. Contextual factors influencing adoption according to the teachers were

learners' motivation, ICT resource, administrative support and perceptions on ICT. These were computed for further analysis.

4.5.2 Challenges Inhibiting Adoption of computer technology in the Schools

Teachers were further asked for additional factors in the school affecting adoption of ICT. The factors were given in form of possible barriers within the school context. The teachers were provided with statements with possible challenges in adoption of computer technology in their schools. In each statement they indicated their opinions by giving an appropriate response as shown n Table 4.17.

Table 4. 17

Challenges inhibiting Adoption of Computer Technology

Challenges	SD (%)	D (%)	N O (%)	A (%)	SA (%)
1. ICT is not well supported by school leadership	26	39	9	15	11
2. The school has no enough computers for teacher use	16	27	5	35	18
3. The school has no enough computers for students use	11	13	6	42	29
4. Getting connected to the internet is not easy	17	25	6	29	22
5. There is not enough technical support	12	25	7	40	16
6. There is no enough support for integrating of technology into instruction	14	34	8	32	13
7. There is no internet connection available	26	40	6	17	11
8. Access to relevant internet sites is blocked	25	42	13	10	10
9. Equipment is not reliable enough/not working	28	44	8	14	7
10. Teachers don't have time to use ICT	19	51	7	17	5
11. Institutional policy doesn't exist to govern ICT use	19	40	10	23	8
12. Inadequate electric power supply or long periods of power disruptions	30	44	5	15	7
13. Teachers don't have enough ICT skills	11	32	8	32	17
14. Teachers have a negative attitude towards technology	27	47	7	14	5
15. There is no seriousness and interest in use of computers among teachers	23	34	7	28	7
16. There was no adequate training for integration of ICT	12	28	7	34	19
17. Technology phobia among teachers	17	36	9	31	8
18. Security of computers is a problem in the school	28	44	7	16	5
19. There is no school policy governing computer use	22	39	9	23	7
20. Computers are not freely accessible	26	45	5	15	9

N=251. SD = strongly disagree; D = disagree; NO = no opinion; A = agree; and SA = strongly agree.

The items concerning challenges in adoption of computer technology had a high loading of 20 factors. Factor analysis was conducted to condense them. Communalities varied from .686 to .187. The Scree test indicated three factors as shown in Table 4.18 of rotated component matrix;

Table 4. 18

Factor Analysis of Challenges Facing Computer Adoption

Rotated Component Matrix[a]

Challenges Facing Computer Adoption	Factors		
	1	2	3
1. ICT is not well supported by school leadership	.518		
2. There are not enough computers for teachers			
3. There are not enough computer for students' use			
4. Getting connected to the internet is not easy	.737		
5. There is not enough technical support	.535		
6. There is no enough support for integration of technology in instruction	.582	.482	
7. There is no internet connection available	.802		
8. Access to relevant internet is blocked	.692		
9. Equipment is not reliable enough/not working	.686		
10. Teachers do not have time to use ICT			
11. Institution policy on ICT does not exist		.623	
12. Inadequate electric power supply/power disruptions		.510	
13. Teachers do not have enough skills			.574
14. Teachers have a negative attitude to technology			.807
15. No seriousness and interest in use of computers among teachers			.803
16. There was no adequate training for integration of ICT			.458
17. Technology phobia among Teachers			.820
18. Security of computers is a problem in the school		.505	
19. There is no school policy governing computer use		.655	
20. Computers are not freely accessible		.601	

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 6 iterations.

The three rotated factors accounted for 46.5% of the covariance among variables. Following varimax rotation, factor one was loaded on 6 items that reflected on *technical support*. It accounted for 16.8% of the variance by the two of the highest loading items, *i.e. there is no internet connection available* and *getting connected to the internet is not*

easy. The second factor was loaded on five items and accounted for 15.4% of the variance and was labeled *policy and access*, while the third factor was also loaded on five items and had a variance of 14.2%. It was labeled *teachers' inadequacies*. The three factors were computed for further analysis. One item was loaded on two factors while three items were not factored. These were therefore left out. A descriptive analysis of the factors showed the means as in Table 4.19.

Table 4. 19 ***Means of Factors of Challenges in Adoption of Computer Technology***

Challenges	Max	Mean	Std. Deviation
1. Technical Support	5.00	2.6	.908
2. Policy and access	5.00	2.4	.816
3. Teacher inadequacies	5.00	2.8	.947

The means of the challenges that posed as hindrances to the adoption of computer technology in ESP schools indicated average scores as indicated in Table 4.19. Technical Support, and policy and access were contextual factors while teacher inadequacies were related to individual teachers' characteristics. Challenges that were associated with the teachers had the highest mean of 2.8 while the lowest mean of 2.4.were factors associated to ICT policy and access. The fact that policy and access were challenges implies that the schools could be having inadequate policies governing ICT implementation. This makes it difficult for school management to support integration of ICT in the classroom. Guidance given by MoE to schools on ICT is that they must develop ICT policies if integration is to become a reality. The policy is the

blue print for sequences of events to achieve adoption and ensuring that ICT becomes part of the teaching and learning culture (MoE, 2013; Tondeur et al. 2007).

Teacher inadequacies were factored with regard to inadequate skills, negative attitude towards technology, and lack of interest, inadequate training and technophobia. These inadequacies were cited as challenges and were more inclined to the teachers' characteristics than contextual factors. Mahmud and Ismail (2008) observed that the teacher characteristics, which include attitude, perception and belief in ICT, access to ICT, age, area of specialization and ICT training were positively correlated to teacher's ICT readiness. Bingimlas (2009) has classified these as teacher level barriers and has similar findings in his Meta-analysis of barriers to successful integration of ICT in teaching and learning.

Technical support was considered a challenge and included lack of connectivity to internet, lack of adequate technical support and unreliable equipment and power supply. These challenges were barriers that affect adoption of ICT in the schools. Anecdotal observations indicated that access to internet is limited in many schools and the few that had connectivity were mainly used for administrative purposes. This concurs with findings done by Kenya School Net (2003), which found out that use of email was yet to be recognized as a tool for collaboration among students and teachers in secondary schools in Kenya.

The results from both teachers and the Ministry officials indicate a similarity on some of the contextual factors such as administrative support, the ICT resources and the perception on the value of the computer technology in teaching and learning.

According to the teachers therefore, the challenges they perceived were additional contextual factors in this finding. These were: ICT resources, administration support, and learner motivation, perceptions on value of ICT in learning, technical support, school policies and access. They were used for further analysis.

4.5.3 Learners' interaction with ICT in School Context

Learners' interaction with the computer technology contributes to the school contextual factors. To triangulate information given by the other respondents therefore, their perspective was sought. They were provided with statements about their school which relate to use of computer technology and asked extent to which they agreed with them. In each statement they were to indicate their opinions by giving an appropriate response using SD for strongly disagree; D for disagree; NS for not sure; A for agree; and SA for strongly agree. Their responses are in Table 4.20.

Table 4. 20 ***Contextual Factors Influencing Learners' use of Computer Technology***

	Mean	Std. Deviation
1. Have opportunity to use computers for class work	2.58	1.40
2. Have access to school computers	2.83	1.43
3. Enough computers in the school	2.68	1.36
4. More motivated to learn	4.11	1.06
5. School has quick release of records	3.57	1.20
6. Very keen in using computers	3.84	1.17
7. Change in way we learn	3.58	1.34

The highest mean (M=4.11, SD= 1.1) was on the influence of computer technology on learner motivation which was reported by 81% of the learners. This was followed closely by their keenness to use ICT (M=3.8, SD=1.2) which was indicated by 65% of learners.

The items concerning learners' interaction with computers in school had a loading of 7 factors. Factor analysis was conducted to condense them. Communalities varied from .673 to .339. The Scree test indicated two factors as shown in the rotated component matrix in table 4.21.

Table 4. 21

Factors on Learners Perspectives on Computer Technology

Rotated Component Matrix[a]

Learners Interaction with Computers	Factors	
	1	2
1. There are enough computers in the school	.677	
2. I Have opportunity to use computers for class work	.780	
3. I Have access to school computers when needed	.754	
4. I am motivated to learn when teachers use computer during learning		.820
5. The school has quick release of records because they are computerized	.448	
6. I am very keen in using computers for instruction		.763
7. There a change in learning due to presence of computers in school		.622

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 3 iterations.

The two rotated factors in Table 4.21 accounted for 55.5% of the covariance among variables. Following varimax rotation, factor one was loaded on 4 items that reflected on *adequacy and access*. It accounted for 28.3% of the variance. The second factor was loaded on three items. It accounted for 27.2% of the variance and was labeled *ICT changes.* The responses from learners therefore were their perspectives on adequacy and access as well as the changes observed by learners as a result of ICT in their schools.

4.5.4. Head Teachers Perspective on Contextual Factors

The head teachers' perspectives on contextual factors that are likely to influence adoption of computers were sought. These opinions were important for triangulating those provided by the teachers and learners. Their responses included aspects such as

adequacy of computers, the teacher student ratio, if the school had computers before receiving those under ESP, number of teachers trained, training received by the head teacher in ICT as well as the uses of the computer technology in the school.

To determine influence of the several predictors on adoption, a hierarchical multiple regression was computed in a sequential way. Each additional set of predictors produced a new model. The first model was on teachers' responses on school context, model two was the context according to head teachers while the third model was context according to the learners' perspective. The 'R' showed the values of the multiple correlations coefficient between predictors and the outcome. Each of the values in R^2 showed how much of the variability in the adoption is accounted for by the predictors in each model. The model summary shows a result of the analysis;

Model Summary[d]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.723[a]	.523	.477	5.046	.523	33.865	6	185	.000
2	.735[b]	.540	.503	5.027	.016	1.284	5	180	.273
3	.752[c]	.566	.526	4.909	.026	5.366	2	178	.005

a. Predictors: (Constant), policy and access, ICT's perception, ICT resource, administrative support, technical support, learner motivation
b. Predictors: (Constant), policy and access, ICT's perception, ICT resource, administrative support, technical support, learner motivation, training in computer, teacher student ratio, number of teachers trained, computers before the ESP, uses of ICT by teachers
c. Predictors: (Constant), policy and access, ICT's perception, ICT resource, administrative support, technical support, learner motivation, training in computer, teacher student ratio, number of teachers trained, computers before the ESP, uses of ICT by teachers, adequacy and accessibility, ICT changes
d. Dependent Variable: summation of access, usage, frequency and attitude

According to the Model summary, the R^2 at model 1 is 47.7%. When another set of variables were included as indicated in model 2 and 3, the predictive ability increased as seen in the increased R^2. The addition of the third set of IVs manifested a 2.3% change and reflects R^2 = 52.6%. This left the rest 47.4% as unexplained. The change statistics showed the differences made as a result of adding new predictors. The significance of *F* Change indicated no significant improvement (p=.273) after the addition of predictors at the second model but a significant improvement after the third set of predictors is added (p<.05). The analysis of variance (ANOVA) tested whether the model was significantly better at predicting the outcome than using the means as a "best guess" (Field, 2005). For the 3 models, the F ratio was high and unlikely to have happened by chance. The third model produced an F of 17.857 hence significant (*p*

<.001). The 12 predictors used together as a set significantly predicted the DV. This showed that the multiple regressions were highly significant.

After multiple regressions was performed between adoption of computer technology as the Dependent variables (DV) and a set of contextual factors as Independent variables (IVs), there were three levels or models. These were representing those cited by teachers, learners and the head teachers. When evaluated, the three models produced an adjusted R2 = 52.6%. This was significantly different from zero (F= 17.857, p<.001) and percentage of the variation in the DV explained by the set of IV's. Further the multiple regression yielded the coefficients shown in the coefficient Table.

Model		Unstandardized		Standardized	t	Sig.	Correlations		
		B	Std. Error	Beta			Zero-order	Partial	Part
1	(Constant)	2.342	3.473		.674	.501			
	ICT resource	1.819	.573	.193	3.177	.002	.488	.227	.161
	learner motivation	2.922	.502	.367	5.822	.000	.580	.393	.295
	administrative support	2.572	.560	.279	4.595	.000	.529	.320	.233
	ICT's perception	-.456	.377	-.063	-1.211	.228	.091	-.089	-.061
	technical support	-1.619	.480	-.198	-3.375	.001	-.363	-.241	-.171
	policy and access	-.077	.530	-.009	-.145	.885	-.284	-.011	-.007
2	(Constant)	.119	4.419		.027	.979			
	ICT resource	1.735	.591	.184	2.936	.004	.488	.214	.148
	learner motivation	2.863	.508	.360	5.640	.000	.580	.388	.285
	administrative support	2.497	.562	.271	4.442	.000	.529	.314	.225
	ICT's perception	-.505	.379	-.070	-1.334	.184	.091	-.099	-.067
	technical support	-1.622	.495	-.198	-3.275	.001	-.363	-.237	-.166
	policy and access	-.330	.540	-.036	-.612	.541	-.284	-.046	-.031
	uses of ICT	.870	.397	.139	2.189	.030	.160	.161	.111
	teacher student ratio	-.022	.074	-.016	-.299	.765	.053	-.022	-.015
	computers before	-.368	.825	-.024	-.446	.656	.054	-.033	-.023
	received training in	1.529	.953	.099	1.605	.110	.027	.119	.081
	teachers trained	-.402	.290	-.073	-1.385	.168	.012	-.103	-.070
3	(Constant)	-5.797	4.835		-1.199	.232			
	ICT resource	1.460	.584	.155	2.500	.013	.488	.184	.123
	learner motivation	2.711	.499	.340	5.436	.000	.580	.377	.268
	administrative support	2.470	.549	.268	4.496	.000	.529	.319	.222
	ICT's perception	-.558	.371	-.077	-1.504	.134	.091	-.112	-.074
	technical support	-1.401	.498	-.171	-2.812	.005	-.363	-.206	-.139
	policy and access	-.577	.541	-.064	-1.067	.287	-.284	-.080	-.053
	uses of ICT	.702	.392	.112	1.790	.075	.160	.133	.088
	teacher student ratio	.012	.073	.008	.158	.874	.053	.012	.008
	computers before	-.729	.822	-.048	-.887	.376	.054	-.066	-.044
	training in computer	1.707	.944	.110	1.808	.072	.027	.134	.089
	teachers trained	-.696	.300	-.127	-2.321	.021	.012	-.171	-.115
	ICT changes	1.232	.878	.094	1.403	.162	.301	.105	.069
	adequacy and access	1.413	.683	.122	2.069	.040	.264	.153	.102

Six significant contextual IV's that made a unique contribution to adoption of computer therefore were; ICT as a resource (sr^2 =.015, t=2.500, *p*= .013); administrative support (sr^2 =.049, t=4.496, *p*=.000); student motivation (sr^2 = .072, t=5.436, *p*= .000); internet support (sr^2 =-.19, t=-2.812, *p*= .005); number of teachers trained (sr^2 = -.013, t=-2.321, p= .021) and adequacy and access of computers to learners (sr^2 =.010, t=2.069, *p*= .040). Given all these magnitude of unique contributions (sr^2), learners motivation therefore had a greater unique contribution at sr^2 =0.072 as compared to the other factors.

The unstandardized β coefficients provided evidence of unique contributions of each contextual IVs. Adoption as a dependant variable had 13 predictors in the school context. Eight of the predictor variables had a positive relationship with the outcome, while the rest had a negative relationship, as shown by the *beta* values. It also showed the degree each predictor affected the outcome when the effects of the other predictors were held constant. There were several *t* values that were not significant at *p* >.05. These were 'perception of ICT', 'policy and access', 'uses of ICT', 'teacher student ratio', 'schools with computers before ESP', 'Head teachers' trained in ICT skills' and 'changes due to ICT'.

Therefore the resultant regression equation is; $Y=b_0+b_1x_1+b_2x_2+b_3x_3+\ldots\ldots e$

Adoption=-5.797 +1.460ICT resource+2.711learner motivation +2.470administrative support+-.558ICT perception+-1.401technicalsupport+.-577policy and access+.702usage of ICT by teachers +.012teacher student ratio+.-729schools with previous computers +1.707H/Teacher training in

computer skills+-.696number of teachers trained +1.232change due to ICT +1.413adequacy and access.

Apart from the objective on prediction of contextual variables on adoption, this section had the following hypothesis;

H_0= There are no significant contextual variables in prediction of adoption

The regression analysis has shown that there were six contextual variables that predicted adoption. The null hypothesis is therefore rejected and the alternative accepted; **H_1=there are significant contextual variables in prediction of adoption as p<.05.**

The findings from the multiple regressions corroborated other studies, which emphasizes that school environment influences adoption of computer technology among other ICT resources. Contextual factors such as infrastructure, equipment, administrative support and instructional leadership, among others, create an enabling environment for computer adoption. Access to ICT facilities, adequacy, teacher and student motivation as well administrative support are very instrumental in adoption of ICT in schools. Mumtaz (2002) and Pelgrum (2001) observed that a school's contextual factors and nurturing of a technological culture by school leadership will determine if it will adopt ICT. Although not considered significant in this finding, factors such as head teachers training in computer knowledge and their computer skills plays an important role in enabling adoption of computer technology. Abdication of leadership and negative attitudes among school leaders towards computers obstructs prioritization of ICT integration and can be counterproductive (Dawson and Rake, 2003; Lee and Gaffney, 2008).

Other factors which were not found significant in this finding include the uses of ICT in the school, changes brought about in the school as a result of ESP ICT component, perceived value of ICT and issues of policy and access. However, this does not imply that these factors were not important for adoption of computers in schools. For example schools ICT policies that are well utilized guides adoption systematically in the way the staff and learners use and access the resources. According to Tondeur et al. (2007) and Baylor and Ritchie (2002), successful adoption is guided by an internal policy plan. This is the blueprint that would ensure adoption of computer technology is accomplished. With an established school policy, it is possible to have significant classroom use of technology as the teachers and learners become computer literate.

Although MoE (2013) argues that the number of computers should not dictate schools' adoption of ICT, the numbers of resources as per the findings are a significant predictor of adoption. Adequacy and access was a significant predictor at $p<0.05$. The rationale of the Ministry of Education that one computer can transform learning in a classroom is therefore an implication that the eleven (11) computers given to ESP schools were enough to initiate adoption of ICT. Respondents however, tended to see this as inadequate in relation to the numbers of learners and teachers. The problem may be with the view that computers are for learning 'with' instead of 'through' and therefore ratio should commensurate number of users as is the case of other learning materials like textbooks. With this regard, Kavagi (2010) postulates that regular access to computers in the school was for only learners taking computer studies as an examinable subject. His observation is that the Computer Studies subject which is

optional in secondary schools i.e. has not only made it difficult for teachers to adopt this potentially versatile tool in their work, but also students whose level of access to computers is based on the subjects opted for.

4.6 Relative Influence of the Individual and Contextual predictors in Adoption of Computer Technology

Relative influence is a comparative way of looking at how individual and contextual variables predict adoption of computer technology in all the sampled ESP secondary schools. In so doing the researcher wanted to establish which of these two levels are more important and whether there are significant predictors when both levels combined.

Hierarchical multiple regression was computed to determine the influence of the predictors. The first model was on individual variables while model two was on contextual variables. These two levels were the independent variables while the adoption was the dependent variable. It was explained by summation of access, usage, frequency of use and attitude. The model summary, ANOVA and coefficient tables showing the results of the analysis are as follows:

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.582[a]	.339	.324	5.91251	.339	23.931	4	187	.000
2	.755[b]	.569	.543	4.86253	.231	13.783	7	180	.000

a. Predictors: (Constant), competence, age, duration, experience

b. Predictors: (Constant), competence, age, duration, experience, adequacy, training, number of teachers trained, teacher student ratio, previous computers, change due to presence of ICT, administrative support

The 'R' showed the values of multiple correlation coefficients between predictors and the outcome. Each of the values in R^2 showed how much of the variability in the adoption is accounted for by the prediction in each model.

The R^2 in model 1 is 33.9% taken care of by the individual variables. When both models are computed together, there is a manifestation of 23.1% change. The contribution of both models account for 56.9%. The significance of F change indicated a significant improvement ($p<.05$) after the second set of predictors. Both models are therefore significant.

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	3346.316	4	836.579	23.931	.000[b]
	Residual	6537.110	187	34.958		
	Total	9883.425	191			
2	Regression	5627.466	11	511.588	21.637	.000[c]
	Residual	4255.959	180	23.644		
	Total	9883.425	191			

a. Dependent Variable: summation of access, usage, frequency, and attitude

a. Predictors: (Constant), competence, age, duration, experience

b. Predictors: (Constant), competence, age, duration, experience, adequacy, training, number of teachers trained, teacher student ratio, previous computers, change due to presence of ICT, administrative support

The ANOVA table shows the model was significant in predicting adoption by the two predictors. The F ratio was high and unlikely to have happened by chance: $F=21.637(p<000)$.

The analysis also resulted in the coefficients shown in the table as follows;

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	7.534	2.142		3.518	.001
	experience	-.930	.697	-.154	-1.334	.184
	Duration	1.049	.429	.178	2.446	.015
	Age	1.020	.690	.170	1.477	.141
	Competence	4.162	.672	.453	6.190	.000
2	(Constant)	-8.834	3.822		-2.311	.022
	Experience	-.751	.578	-.124	-1.299	.196
	Duration	1.094	.357	.186	3.062	.003
	Age	.681	.575	.114	1.186	.237
	Competence	2.487	.580	.271	4.289	.000
	Previous computers	-.774	.792	-.051	-.978	.329
	Training	.640	.795	.041	.805	.422
	Teachers trained	-.600	.290	-.110	-2.067	.040
	Adequacy	-1.152	.329	-.208	-3.502	.001
	Change due to presence of ICT	2.748	.733	.211	3.746	.000
	Administrative support	4.733	.564	.514	8.395	.000
	Teacher student ratio	.034	.071	.024	.478	.633

a. Dependent Variable: summation of access, usage ,frequency and attitude

Out of the 11 individual and contextual predictors, 4 of them had a negative relationship with the outcome variable while 7 had a positive relationship as shown by the standardized beta values. Six variable had “t” value of $p<0.05$. These were duration ($p=0.03$), competence ($p=0.000$), number of teachers trained ($p=0.040$), adequacy

(p=0.001), changes in school due to presence of ICT (p=000) and administrative supportive (p=.000).

Using the equation; $Y=b_o+b_1 x_1+b_2x_2+b_3x_3+\ldots\ldots e$. The resultant equation is;

Adoption=-8.834+-751(experience)+1.094(duration)+.681(age) +2.487(competence) +-.774 (computers) +.640 (training) +-600 (teachers trained) +-1.152(adequacy) +2.748(change due to presence of ICT) +4.733(administrative support) +.034(teacher student ratio)…..+e.

Further to establish the relative influence of the individual characteristics and contextual predictors in adoption of computer technology. Multi level analysis was done at two levels using MLwiN soft ware. Since individual data is nested in the contextual variability of the two levels was decomposed into variability of the IVs. The first output of the null model which only shows the constant without predictor variables showed that an interclass correlation (ICC) of 18.27% of the total variance of adoption was attributed to context predictors. The fixed and random effects of the two levels on adoption of computer technology in schools are illustrated in Table 4.23.

Apart from the objective on relative influence of the individual and contextual variables in predicting adoption, this section had the following hypothesis;

H0; There is no significant difference between individual characteristics and school context in predicting adoption

Given that the interclass correlation (ICC) of 18.27% of the total variance of adoption of computer technology was attributed to context level, the remaining 81.73% was explained by other factors, among the individual predictors. This however did not measure significance. On the other hand, the regression of the hierarchical multiple regression showed that when the predictors are combined, majority of them were significant. The null hypothesis is therefore accepted.

Table 4. 22 ***Fixed and Random Effects of the Individual Characteristics and Contextual Factors***

	Model 1		**Model 2**		**Model 3**		**Model 4**		**Model 5**		**Model 6**		**Model 7**	
Fixed effects	**β**	**SE**	**β**	**SE**	**B**	**SE**	**β**	**SE**	**β**	**SE**	**β**	**SE**	**β**	**SE**
Intercept	24.64	0.54	22.88	1.01	10.14	2.86	9.36	3.14	-6.67	3.43	-10.78	3.61	-14.89	3.69
Gender			2.82	.944	1.904	.823	1.535	.879	.047	.825	1.056	.764	.956	.730
Age31-35yrs			.434	1.073	.245	.925	.993	1.031	.591	.946	.459	.859	.253	.827
Age 36-40 yrs			-.551	1.326	.577	1.155	1.834	1.240	1.737	1.130	1.407	1.018	.882	.978
Age above 40			-1.407	1.128	-1.196	.992	.626	1.109	-.154	.976	-.394	.892	.523	.849
Usage <1yr					6.547	2.566	6.550	2.534	6.630	2.324	1.600	2.181	1.332	2.094
Usage 1-2yrs					6.940	2.582	6.386	2.553	6.425	2.347	1.919	2.182	1.478	2.115
Usage 3-4yrs					7.730	2.611	8.061	2.612	7.345	2.388	3.224	2.205	2.842	2.115
Usage >4yrs					-1.196	.992	6.260	2.623	9.647	2.402	5.344	2.226	4.743	2.136
Competence-limited					1.516	2.582	.905	2.538	1.342	2.300	1.174	2.067	1.392	2.017
Competence-some					4.594	2.508	4.695	2.459	4.375	2.235	3.937	2.001	3.797	1.919
Competence-quite					8.572	2.591	8.821	2.574	7.310	2.348	5.772	2.117	5.332	2.032
H/TR Training							.547	1.036	.069	.796	-.942	.886	-.877	.816
Teachers Trained							-.058	.369	-.207	.286	-.307	.270	-.384	.254
ICT Resources									3.419	.507	2.722	.474	1.710	.509
Computers before									.125	.801	-.705	.774	-.556	.725
Adequacy &access									1.650	.628	.646	.368	1.075	.594
Uses of ICT											.646	.368	.505	.344
Administrative support											3.291	.462	2.891	.452
Teacher student ratio											-016	.070	-.009	.064
Student motivation													1.783	.435
Change in learning													1.195	.766
Value of ICT													.249	.325
Random effects	**σ^2**	**SE**	**σ^2**	**SE**	**σ^2**	**SE**	**σ^2**	**SE**	**σ^2**	**SE**	**σ^2**	**SE**	**σ^2**	**SE**
Contextual level	8.87	3.57	8.91	3.46	4.55	2.26	4.85	2.48	.341	1.494	.667	1.251	.000	.000
Individual level	39.68	4.16	37.59	3.94	28.37	2.97	26.68	3.12	23.957	2.809	18.726	2.223	17.498	1.786
Variance component														
% contextual	**18.27**		**19.16**		**13.82**		**15.38**		**1.40**		**3.44**		**0**	
% individual	**81.73**		**80.84**		**86.18**		**84.62**		**98.60**		**96.56**		**100**	
Model fit														
2loglikelihood(IGLS Deviance)	**1677.0**		**1665.3**		**1583.5**		**1251.9**		**1187.5**		**1113.8**		**1094.4**	
Change in-2loglikelihood (X^2)		**11.72**		**81.7**		**331.6**		**64.4**		**71.7**		**19.4**		
			p>0.001		**P<0.0001**		**P<0.0001**		**P<0.0001**		**P<0.0001**		**p>0.0001**	

The fixed and random effects of individual teacher characteristics and contextual factors on adoption of computer technology in schools presented in Table 4.23 shows the Null (intercept only) model as indicated in model 1 gave a significant average score (β= 24.6; $p< 0.05$) across all variables. The intercept only model estimates the school level variance of 8.87and individual level 39.68, which gave a total variance of 48.55. The proportion of variance at the contextual and individual level was 18.27% and 81.73% respectively.

This showed about18.27% of the total variance in adoption of computer technology in schools may be attributed to contextual factors. This implies that the remaining 81.73% could be accounted for by the individual teacher characteristics.

To the null model, predictor variables were added in the subsequent models one after the other to detect their potential as significant determinants of computer adoption. Use of null model served as a baseline to compare subsequent models. It also partitioned the total variance of adoption of computer technology into ‘between schools’ and ‘between teachers within the schools’.

The second output had a calculation of general or grand means of all schools in adoption. This took into account the two levels of the independent variables, one nested on the other. The grand mean is shown in figure 10.

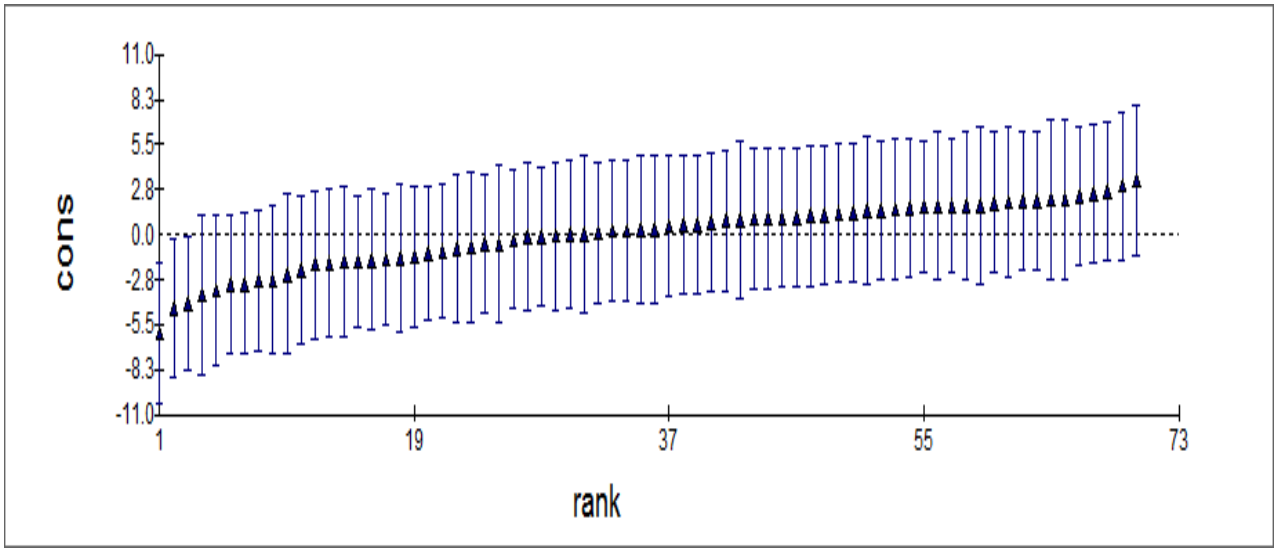


Figure 10. **Grand Means of Schools in Adoption of computer technology**

The Figure 10 shows the average means of all schools when computed together. In the 70 schools there was no big variation as they range from -5.5 to 2.8. About a third of the schools were below the mean, which indicated that several schools were performing below the grand mean, and implies a very low level of adoption. It was possible that in some of these schools, adoption of computer technology was yet to be implemented. Those were the schools indicating a very low mean. Three particular schools were significantly below the mean. About a third of other schools were performing above expectation as far as adoption is concerned.

As implied by the theory of ecological system which underpins this study, individuals operate and develop in hierarchical nature of their environments. The different levels such as these depicted in this study interact and influence each other. The interaction among individuals and between the individuals and the school context are systemic. Different teacher characteristics were depicted in the 2nd and 3rd models. This is the micro level according to the ecological theory. The teachers' interactions with the ICT resources and with the learners in the classroom environmental depicted the meso level. The interactions within the systems therefore enable learning to take place.

According to the findings on relative influence, the teachers' individual characteristics played a bigger role (88.7%) in adoption as compared to the contextual factors 18.27%. Effects of the contextual factors will cascade to the others through influence of interactions of the teacher (micro) and the classroom (meso) environments (Widaman, 2007). Although the influence of contextual factors in adoption of ICT is relatively low, Olson (2000) has observed that practices and school culture determines how and why teachers will respond to ICT in the classroom. The teacher cannot be removed from the context in which he or she operates. This concurs with what Zhao et al (2002) suggest when they say that factors which influence adoption are intertwined, influence each other and also determine the success and failure of technology adoption in schools.

Although the teacher characteristics had a bigger role in adoption according to these findings, contextual factors equally can lead to non-adoption, even if the most useful innovation is available (Rogers, 1995). All the levels therefore act together to shape the ultimate use of the computer technology in schools.

4.7 Chapter Summary

This chapter presented the analysis of findings, their interpretations and discussions. First respondent bio-data was provided which considered their background information. These respondents were head teachers, teachers and learners in ESP schools as well as representatives from various departments of the Ministry of education (MoEST).

Graphs and tables were used to present the results. The results showed that the individual and contextual factors are very distinct. Teachers have unique characteristics which often influence their adoption of computer technology. The other respondents have their own perceptions on teacher characteristics that influence adoption. Similarly, each category of respondents had various contributions in their opinions on contextual factors. Both the individual and contextual factors were considered as the independent variables while adoption of computer technology was considered as the dependent variables. Descriptive analysis was done where percentages, means and variances were used. Inferential analysis too using multiple regressions was performed first on each independent variable followed by both independent variables using multi level analysis software to determine the relative influence of the two independent variables on adoption. Interpretations of the findings were given followed by a discussion of the findings.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

The purpose of this study was to find out the influence of the individual characteristics and school contextual predictors on adoption of computer technology in the Economic Stimulus Programme schools. The specific objectives of this study were to:

i. Establish the extent of adoption of computer technology in ESP schools.
ii. Determine the extent to which individual characteristics predict adoption of technology in teaching and learning.
iii. Assess the extent to which contextual factors predict adoption of computer technology in the ESP schools.
iv. Establish the relative influence of the individual characteristics and contextual predictors in adoption of computer technology in ESP schools.
v. Determine the individual and contextual challenges experienced by the ESP schools in adoption of computer technology ESP schools.

This chapter presents the summary of the findings, the conclusions and recommendations generated from the findings which were guided by the objectives of the study. The chapter also provides suggestions for further research.

5.1 Summary of Findings

This section discusses the summary of the findings according to the objectives of the study. The study sought to find out the influence of the individual characteristics and contextual predictors in adoption of computer technology in the Economic Stimulus Programme (ESP) schools. First, it sought to find out the extent of adoption of computer technology in ESP school.

5.1.1 Extent of Adoption of Computer Technology in ESP Schools

The first objective sought to establish the extent to which computer technology had been adopted in ESP schools. Teachers' experiences in using computers, perceived levels of competence, access, uses and frequency of use as well as attitude were the main indicators of adoption. Most teachers' experiences in using computers were less than four years. Only a few teachers had an experience of more than the four years.

Perceived levels of competence were high among 39% of the teachers who said they were 'quite experienced'. Computer resources were more readily accessible and available to the teachers than to learners. The desktop computer was the most accessible resource to most teachers. Learners' access to computers was limited.

Extent of adoption was explained further by the usage of the computer technology in the ESP schools. The ICT resources are used mainly for administrative or instructional purposes and minimally for communication. Use of the computer technology however, is mostly in Computer Studies and science subjects such as Biology, Chemistry and Physics. In the other subjects, usage was very low. Despite

varied use of computer technology in ESP schools, the frequency of use in most tasks was relatively low. The most frequent use was in learning computer skills, preparing and keeping records such as schemes of work and examination. Teachers mostly agreed with statements on their attitude towards ICT. There was inadequate monitoring for ESP-ICT component which could be affecting the rate at which adoption is taking place.

5.1.2 Extent to which Individual Characteristics predict Adoption of Computer Technology

The second objective was assessing the influence of the individual teachers' characteristics on adoption of the computer technology. The findings showed that age and experience were not significant predictors of adoption. This was a contrary to some studies (Waugh, 2004; Kotrlik and Redmann, 2009) whose observations indicate that the younger the teachers, the more likely they are to adopt computer technology. Duration of computer usage and teachers levels of competence are the two individual characteristics that significantly made a unique contribution to adoption of ICT in ESP schools. Adjusted R^2 showed that 28.8% can be explained by the variations in all the Independent Variables under teacher characteristics taken together thus leaving 71.2% unexplained.

Positive teachers' immediacy behavior creates suitable environment for interactions that motivate learners toward the innovations in the classroom. This result corroborates other studies done on ICT integration that have shown that adoption of computer

technology in schools largely depends on the individual teachers as they interact with the learners.

5.1.3 Extent to which Contextual Factors predict Adoption of Computer Technology

The third objective sought to assess the influence of contextual factors on adoption as perceived by different respondents. For each level of respondent in the school, was a model in the regression analysis output. According to the teachers' level, contextual factors were ICT as resource, computers for learner motivation, administrative support and perceptions on value of ICT. In addition, the challenges teachers perceived on contextual factors included technical support, school policies and access.

The head teachers' and learners' perspectives on contextual factors likely to influence adoption of computers were sought in order to triangulate those provided by the teachers. The head teachers' responses included aspects such as adequacy of computers, the teacher student ratio, previous availability of computers, number of teachers trained, their own computer training, as well as the usage of the computer technology in the school. The responses from learners included their perspectives on adequacy and access as well as the changes observed as a result of ICT in their schools.

Eight of the predictor variables had a positive relationship with the outcome, while the rest had a negative relationship, as shown by the *beta* values in the hierarchical multiple regression. The regression analysis also showed the degree each predictor affected the outcome when the effects of the other predictors were held constant. There were several *t* values that were not significant at $p > .05$. These were 'perception of ICT', 'policy and access', 'usage of ICT', 'teacher student ratio', 'schools with computers before ESP',

'Head teachers trained in ICT skills' and 'changes due to ICT. Nevertheless these factors were important for adoption of computers in schools.

5.1.4. Challenges Experienced in Adoption of Computer Technology

The fourth objective sought to find out challenges experienced by teacher in adoption of computer technology in the ESP schools. There were three main sets of challenges experienced in the adoption of computer technology in ESP schools. Inadequate technical support and internet connectivity, policy issues and access to the ICT resources were the two main sets of school factors identified. The policy issues included lack of institutional policy governing ICT use and insecurity for the computers.

The third set of challenges was in relation to the teacher inadequacies. They were associated with teachers' beliefs, lack of enough skills, teachers' techno phobia and negative attitude to technology use in learning. Although the means of the three sets of factors were average, challenges associated with the teachers had the highest mean of 2.8 while the lowest mean of 2.4.were factors associated with ICT policy and access.

5.1.5 Relative Influence of the Individual Characteristics and Contextual predictors in Adoption of Computer Technology

The other main objective of this study was to find out the relative influence of the two levels namely individual characteristics and contextual factors in adoption of computer technology.

The parameters of the multilevel model were estimated using the iterative generalized least squires estimation procedure availed in the MLwiN software. The Null (intercept only) model gave a significant average score ($\beta = 24.6$; $p < 0.05$) across all variables. For the interclass correlations, the proportion of variance at the contextual and individual level was 18.27% and 81.73% respectively.

The two levels depicted in this objective interact and influence each other. However, the interaction among individuals and between the individuals and the school context are systemic, although the individual characteristics played a relatively bigger role. Olson (2000) and Rogers (1995) observed that practice and school culture are important in determining how and why teachers respond to ICT in the classroom. All the levels therefore act together to shape the ultimate use of the computer technology in schools.

5.2 Conclusions

The study sought to find out the influence of the individual characteristics and school contextual predictors in adoption of computer technology in the Economic Stimulus Programme schools. Based on the findings, the following conclusions were made.

5.2.1 Extent of Adoption of Computer Technology in ESP Schools

The first objective sought to find out the extent to which computer technology had been adopted in ESP Schools. Based on this objective, it was concluded that the teachers and learners had access to the ICT resources in varying degrees, most teachers had inadequate competence, and ICT resources provided in ESP schools had been used in various ways. However the frequency of using computer technology was relatively low and hence, the extent of adoption was still low. Despite of provision of infrastructure,

capacity building and digital content, teachers did not adequately take advantage of the potential of ICT in their schools.

5.2.2 Extent of Individual Characteristics in prediction of Adoption of Computer Technology

The second objective of this study was to find out the influence of individual teacher characteristics on adoption. Duration of computer use and perceived levels of competence were significant predictors of adoption. Other teacher characteristics though important did not significantly predict adoption. These included age and teaching experience. Teacher immediacy behavior does influence learners' adoption of technology in class.

5.2.3 Extent to which Contextual Factors Predict Adoption of Computer Technology

The third research objective was on the influence of contextual factors on adoption. Based on this objective, it was concluded that the six significant contextual IV's that made a unique contribution to adoption of computer therefore were; ICT as a resource, administrative support, learner motivation, technical support, number of teachers trained and adequacy and access of computers.

5.2.4 Challenges Experienced in Adoption of Computer Technology

There were three main sets of challenges experienced in the adoption of computer technology in ESP schools. Two were in relation to contextual factors and included inadequate technical support and internet connectivity; and policy issues and access to

the ICT resources. The third set of challenges was in relation to the teacher inadequacies. They were associated with teachers' beliefs, lack of enough skills, techno phobia among teachers and negative attitude to technology use in learning.

5.2.5 Relative Influence of the Individual Characteristics and Contextual Factors in predicting Adoption of Computer Technology

This objective conclusively found out that the extent to which computer technology has been adopted in ESP schools is largely determined by the individual teacher characteristics. The teachers' individual characteristics played a higher role in adoption of computer technology in ESP schools as compared to the contextual factors. However the factors which influence adoption are intertwined and interact with each other to determine the success and failure of technology adoption in schools. The entire levels act together to shape the ultimate use of the computer technology in schools. The interaction among individuals and between the individuals and the school context therefore are systemic in nature.

5.3 Recommendations

The study established that despite of access and some competence, extent of adoption of computer technology was low. It also established that individual characteristics such as duration of computer use and perceived levels of competence, as well as contextual factors such as administrative support, learner motivation, technical support, number of teachers trained and adequacy of computers were found to significantly influence adoption. In addition, adoption of computer technology was found to be inhibited by inadequate technical support, policy issues and teacher inadequacies. The

recommendations cut across the objectives because the variables on individual and contextual predictors are intertwined. Based on these findings therefore, the following recommendations were made;-

5.3.1 Training of Teachers in ICT Integration

With the findings that teacher characteristics have a relatively larger influence on adoption of computer technology in ESP schools in relation to contextual factors, it is necessary that all teachers' capacity in integration of ICT in teaching be enhanced. There should be continuous professional development for practicing teachers to guide in adoption of computer technology in schools. In all teachers training courses there should be an examinable core ICT unit on adoption. The publishers should be tasked to develop adoption manuals to help teachers navigate through the process of integration in any given content.

5.3.2 Formulation of School ICT Policies

For adoption to be a reality in secondary schools, all ESP schools should have ICT policy guidelines. In doing so, there will be progressive adoption of computer technology in schools as they should stipulate how the ICT resources are utilized and secured. These policy guidelines should be developed by the ESP schools in tandem with their vision and mission and also with the education ICT policy from the Ministry of Education.

The MoHEST should ensure the schools are using the ICT resources by requiring all liaisons with the schools be done through IT. Using innovations like accessing

curriculum content on the web and sample assessment papers can enhance adoption by schools. Such issues should be included in school ICT policies.

5.3.3 Monitoring and Evaluation of the ICT Component of ESP

The ICT 4D in MoEST needs to initiate regular monitoring and evaluation systems. Regular monitoring will serve in evaluating and enhancing adoption and ensure that the large investment by the government on ICT infrastructure for schools is not wasted. It will also help to build a critical mass required for the paradigm shift in teaching. For every county, there should be specific ICT officers with the responsibility of giving technical assistance and follow up implementation of ICT policy in schools within the counties.

5.3.4 Motivation of Teachers in Adoption of Computer Technology

Ministry of Education should have incentives for efforts made in adoption, either to individual teachers or their schools. Recognized efforts enhance motivation as it is a reward in itself. Certification should be done for teachers who make a lot of effort in integrating ICT and when promotions are done innovations by teachers or schools ought to be a major consideration.

5.3.5 Curriculum Implementation for Adoption of Computer Technology

There is need for a paradigm shift in the process of curriculum implementation in schools. During curriculum development, all implementers should be guided by the curriculum on how computer technology can be adopted.

The MoHEST needs to reconcile individual characteristics among teachers vis a vis specific contextual background or environment in which the teachers must adopt ICT; otherwise adoption will remain a distant goal in education.

5.4 Suggestions for Further Research

This study focused on influence of the individual characteristics and contextual factors in adoption of computer technology. It is recommended that further research be conducted in the following areas;

a) Adoption of ICT in schools in order to assess relationship between teacher characteristics and learner motivation in technology use.

b) Further, a comprehensive study needs to be undertaken that takes into consideration the wider dimension of the ICT policies in education which are made at the macro level as contextualized in this study.

c) Since this study concentrated on the ESP public schools, studies on uptake of ICT in non-ESP schools as well as private schools should be undertaken.

d) Finally, further research should be done to find out the take up of computer technology in relation to value addition in school performance.

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APPENDICES

APPENDIX 1 Table of identifying Sample size

Required Sample Size†

Population Size	Confidence = 95% Margin of Error				Confidence = 99% Margin of Error			
	5.0%	3.5%	2.5%	1.0%	5.0%	3.5%	2.5%	1.0%
10	10	10	10	10	10	10	10	10
20	19	20	20	20	19	20	20	20
30	28	29	29	30	29	29	30	30
50	44	47	48	50	47	48	49	50
75	63	69	72	74	67	71	73	75
100	80	89	94	99	87	93	96	99
150	108	126	137	148	122	135	142	149
200	132	160	177	196	154	174	186	198
250	152	190	215	244	182	211	229	246
300	169	217	251	291	207	246	270	295
400	196	265	318	384	250	309	348	391
500	217	306	377	475	285	365	421	485
600	234	340	432	565	315	416	490	579
700	248	370	481	653	341	462	554	672
800	260	396	526	739	363	503	615	763
1,000	278	440	606	906	399	575	727	943
1,200	291	474	674	1067	427	636	827	1119
1,500	306	515	759	1297	460	712	959	1376
2,000	322	563	869	1655	498	808	1141	1785
2,500	333	597	952	1984	524	879	1288	2173
3,500	346	641	1068	2565	558	977	1510	2890
5,000	357	678	1176	3288	586	1066	1734	3842
7,500	365	710	1275	4211	610	1147	1960	5165
10,000	370	727	1332	4899	622	1193	2098	6239
25,000	378	760	1448	6939	646	1285	2399	9972
50,000	381	772	1491	8056	655	1318	2520	12455
75,000	382	776	1506	8514	658	1330	2563	13583
100,000	383	778	1513	8762	659	1336	2585	14227
250,000	384	782	1527	9248	662	1347	2626	15555
500,000	384	783	1532	9423	663	1350	2640	16055
1,000,000	384	783	1534	9512	663	1352	2647	16317
2,500,000	384	784	1536	9567	663	1353	2651	16478
10,000,000	384	784	1536	9594	663	1354	2653	16560
100,000,000	384	784	1537	9603	663	1354	2654	16584
300,000,000	384	784	1537	9603	663	1354	2654	16586

APPENDIX 2A HEAD TEACHERS QUESTIONNAIRE

Dear Respondent,

I am a PhD student in the School of Education at Moi University. I am interested in exploring the Computer Technology adoption in secondary schools in Kenya under the Economic Stimulus Programme. The purpose of this study therefore is to find out the influence of individual teacher characteristics and the school-related characteristics that influence adoption of computer technology at the classroom level.

Your response to this survey questions is very important because the results may be useful in informing ICT policies in Education as well as ICT curriculum development process. Any information you provide will be treated with utmost confidentiality and used only for the purpose of this study.

Instructions: Most questions in the following sections of the survey have answers in a multiple-choice format. Kindly respond to all the items by putting a tick (√) or filling in the blanks at the appropriate spaces

Section A: Background information

1. What is your gender? Male ☐ Female ☐

2. For how long have you been the Principal in your current school? ____ years

3. Number of teachers in the school? _____

4. How many teachers have received training in integration and use of ICT in your school? (Indicate numbers and subject areas).

Subject	No. of teachers

5. What is the total number of students in the school? _____

Section B: How computer Technology is used in your School

6. Did you have computers before you got what your school now has under the Economic Stimulus Programme?

   Yes ☐ No ☐

7. What difference has the Economic Stimulus Programme made in your use of computer technology as a school? (e.g. for administrative purposes, learning basic skills and use in teaching and learning)

   .....

   .....

8. How are computers used in your school by teachers and students?

   Teachers learn basic skills ☐

   Students learn basic skills ☐

   For instructional use in class ☐

   For keeping records ☐

   For sourcing for information ☐

   Any other (Specify) _____

Section C: Contextual / school related factors

9. Have you received training in using the computer technology to support the teachers in using the same in the school?

   Yes ☐ No ☐

10. How do you motivate teachers who implement new teaching practices using the computer technology?

    .....

    .....

11. What has the school done to support adoption of computer technology in the school? (e.g. ICT policies, keeping records, administrative, provision of adequate infrastructure, budget etc)

.....

.....

Section D: Teacher characteristics

13. Comment on any teacher related factors that **hinder or enhance** use of the ICT resources in your school.

Enhancing factors.....

.....

Hindering factors…….....

……..

Section E; Challenges

14. What are some of the barriers which hinder effective computer use in your school?

.....

.....

THANK YOU

APPENDIX 2B TEACHERS QUESTIONNAIRE

Dear respondent,

I am a PhD student in the School of Education at Moi University. I am interested in exploring the Computer Technology adoption in secondary schools under the Economic Stimulus Programme in Kenya. The purpose of this study therefore is to find out the influence of individual teacher characteristics and the school-related characteristics that influence adoption of computer technology at the classroom level. Your response to this survey questions is very important because the results may be useful in informing ICT policies in Education as well as ICT curriculum development process. Any information you provide will be treated with utmost confidentiality and used only for the purpose of this study.

Instructions

Most questions in the following sections of the survey have answers in a multiple-choice format. Kindly respond to all the items by putting a tick (√) or filling in the blanks at the appropriate spaces.

Section A: Background Information

1. What is your main teaching subject? .....

2. What is your gender? Male ☐ Female ☐

3. What is your teaching experience in years?

   Below 2years ☐ 2-6years ☐ 7-10years ☐ above10 years ☐

4. How long have you been using the computer technology?

Never ☐ less than 1 year ☐ 1-2 years ☐ 3-4 years ☐ more than 4 years ☐

5. What is your average age in years?

   Less than 30 ☐ 30-35 ☐ 36-40 ☐ ☐ above 40

6. What is your level of competence in computer use?

None ☐ limited ☐ Some experience ☐ Quite ☐ experienced

Section B: uses of computers in school

7. Using 'Yes' or 'No' as your response, indicate if the following **computer** resources are accessible at your school for teaching/ learning activities.

Resource	**Access to the Teachers**	**Access to students**
Desktop Computers		
Laptop		
Printer		
Internet connection		
DVD player		
Any other (specify)		

8. How do you use computer technology in your school?(please put a tick(√) where applicable)

i. Teachers learn basic skills ☐

ii. Students learn basic skills ☐

iii. For instructional use in class ☐

iv. For keeping records ☐

v. For sourcing for information ☐

vi. Any other (Specify)_____

9. The following statements indicate possible uses of computer technology in school. For each statement, please select **any <u>one option</u>** from choices provided to show your **frequency** of computer technology use;

10. Where do you have access to **computer technology** in your institution and what do you use it for in that location? (put a tick (√) on all that apply)

Location	**tick (√)**	**Reason for use**
Staff room		
My Office		
HoDs office		
Principal's office		
Classroom		
Computer room		
Library		
Other (specify).....		

	Never	**Rarely**	**Sometimes**	**Often**	**Always**
Teaching in your subject area					
Online documents /materials search from the internet for your lessons					
Making PowerPoint presentations					
Preparing schemes of work and lesson notes					
Keeping records to track learners progress such as mark lists					
Communication with learners					
Communicating with parents					
Communicating with administration					
Preparing handouts for learners					
Learning basic skills					
Teaching learners basic skills					
Any other use (Specify)……					

Section C: School Context and Use of Computer Technology

11. The following are statements about the **factors in your school** that influence use of computer technology. Indicate your opinion on each statement by ticking (√) the appropriate response. Key: **SD = strongly disagree; D = disagree; NO = no opinion; A = agree; SA = strongly agree**

12.

	SD	**D**	**NO**	**A**	**SA**
ICT gives students access to a wider range of learning content and resources					
Students are more attentive when using ICT					
ICT doesn't motivate students					
ICT helps students become more active and independent in the learning process					
With ICT students become lazy					
Students get disrupted from their main learning agenda					
If you have a good library you don't need ICT					
ICT doesn't add much value to students' learning of subject matter					
Students are more motivated to learn when I use ICT					
Students understand subject matter more deeply when they use ICT					
There are enough computers at the school for my use					
I have been provided with training opportunity on using the computer					
Adequate technical support is available at the school to assist when computer problems occur					
I have access to school computers whenever I need to use them for teaching					
Adequate support is available from the head teacher on integrating technology into classroom instruction					
I receive incentives from my school to explore or implement new technology innovations					

Section D: Individual Teacher Characteristics and Adoption of Technology in Teaching and Learning

13. The following statements show how the computer technology possibly **influences you in your teaching**. Indicate your opinion on each statement by ticking the appropriate response. Key: **SD = strongly disagree; D = disagree; NO = no opinion; A = agree; SA = strongly agree.**

	SD	D	NO	A	SA
ICT helps me provide more effective instruction					
ICT gives me a lot more work					
ICT doesn't add value to my teaching					
ICT allows me more insight into student's performance					
ICT helps me to facilitate learning through small group work					
ICT helps me develop students who become better problem solvers					
ICT allows teachers more time to help individual students					
ICT helps me communicate more effectively					
ICT makes it easier to collaborate with colleagues					
I don't need ICT to understand how well my students are doing					
ICT provides a greater range of resources to the teacher					
Training on ICT focused on technology in my subject					
The training on ICT guided me on integrating technology in my subject					
The training showed how I can use computer technology to make teaching more effective					
I am able to use technology in my subject area					
I give students access to ICT resources for learning					
Students are more attentive when I use ICT in teaching					
Students are more motivated to learn when I share a computer with them during learning					
Students understand subject matter more deeply when I use ICT for instruction					
I depend more on conventional mode of teaching than on technology					
I use email to provide computer access to the learners to work in a small group discussions as I observe them					
I provide notes/ assignments for my class during or after the lesson using email					
I am very keen in using computer technology for instruction					
There has been a change in my instructional methods since ESP began					

Section E: Challenges in adoption of computer technology

14. The following statements are possible barriers to using ICT for teaching and learning in the school. Tick an appropriate response that relate to your school. Key: **SD = strongly disagree; D = disagree; NO = no opinion; A = agree; SA = strongly agree.**

Possible barriers	**SD**	**D**	**N O**	**A**	**SA**
ICT is not well supported by school leadership					
The school has enough computers for teachers' use					
The school has enough computers for students' use					
Getting connected to the internet is not easy					
There is not enough technical support in my school					
There is inadequate support for integrating of technology in instruction					
There is no internet connection available					
Access to relevant internet sites is blocked					
Equipment is not reliable enough					
Teachers don't have time to use ICT					
Institutional policy doesn't exist to govern ICT use					
Inadequate electric power supply or long periods of power disruptions hinder effective use of ICT					
Teachers don't have enough skills to be able to use ICT effectively					
Teachers have a negative attitude towards technology					
There is no seriousness and interest in use of computers among teachers					
There was no adequate training for integration of ICT					
There is technology phobia among teachers					
Security of computers is a problem in the school					
There is no school policy governing computer use					
Computers are not freely accessible					

THANK YOU

APPENDIX 2C QUESTIONNAIRE FOR LEARNERS

Dear respondent,

This questionnaire is exploring the computer technology use in secondary schools in Kenya. Its purpose is to find out how the teachers and school-related factors influence adoption of computer technology in the classroom.

Your response to this survey questions is very important because the results may be useful in informing ICT policies in education as well as ICT curriculum development process. Any information you provide will be treated with utmost confidentiality and used only for the purpose of this study.

Instructions

Kindly respond to all the items by putting a tick (√) or filling in the blanks at the appropriate spaces.

Section A; Background information

1. What is your sex? Male ☐ Female ☐

2. What is your class? Form 2 ☐ Form 3 ☐ Form 4 ☐

Section B: Access and use of computers

3. Do you have access to the computers in the school? Yes ☐ No ☐

4. From where do you access the computer technology in the school? (tick (√) all that apply)

Computer lab ☐ the classroom ☐ the library ☐

Anywhere else (specify) _____

5. Which of the following computer technology do you have access to in school and out of school?

Technology	**In school**	**Out of school**
Desk top computer		
Laptop		
Printer		
LCD Projector		
Internet		
None		

6. In which subject (s) do your teacher(s) mostly use computers?

.....

.....

7. What is your frequency of computer use in each of the following tasks?

Task	**Very often**	**Often**	**No opinion**	**Rarely**	**Never**
Learning basic skill					
Class assignments					
Sourcing information for further reading					
Surf the internet					
Emailing					
Chatting					
Playing games					
Downloading music					
Other (specify)					

Section C: School context and use of computers

The following are statements about your possible use of computers in the school. Please indicate extent to which you agree with the statements below by putting a tick (√**)** on **any one option** for each statement. **Key: SA = strongly agree: A = agree: D = disagree: NS=not sure: SD = strongly disagree**

	SA	**A**	**NS**	**D**	**SD**
There are enough computers at the school					
I have been provided with an opportunity to use the computer for class work					
I have access to school computers whenever I need to use them for learning					
I am more motivated to learn when the teacher uses a computer during learning					
The school has quick release of any records because they are computerized					
I am very keen in using computer technology for instruction					
There has been a change in the way we learn since computers were bought in our school					

Section D: Teachers' characteristics

The following are statements concerning the teacher(s) who teach (es) you using computer technology. Choose **any one option** to indicate the extent to which you agree with each statement. Key: **SA = strongly agree: A = agree:; D = disagree: U=undecided: SD = strongly disagree**

	SA	A	U	D	SD
Sometime the teacher rarely looks at us on the eye when teaching					
The teacher uses a lot of non verbal communication when teaching					
The teacher's physical appearance attracts us to the subject					
There is a lot of teacher–student interaction in the classroom during the lesson					
The teacher uses a lot of gestures and dynamism while teaching					
The teacher's facial expressions are encouraging for learning					
The teacher makes positive remarks when answering our questions.					
The teacher has a friendly smile when teaching					
The teacher uses humor in the course of teaching					
The teachers does not move away from his/her desk during the lesson					
The classroom environment is suitable for teacher-student interaction					

THANK YOU

APPENDIX 2D INTERVIEW SCHEDULE FOR MOEST OFFICERS

Dear respondent,

I am a PhD student in the School of Education at Moi University. I am interested in exploring the Computer Technology adoption in secondary schools in Kenya under the Economic Stimulus Programme. The purpose of this study therefore is to find out the influence of individual teacher characteristics and the school-related characteristics that influence adoption of computer technology at the classroom level.

Your response to this interview is very important because the results may be useful in informing ICT policies in Education as well as ICT curriculum development process. Any information you provide will be treated with utmost confidentiality and used only for the purpose of this study.

Section A: Background information

Gender of respondent: Male ☐ Female ☐

Designation of respondent: MoEST ICT officer ☐ KICD ICT officer ☐

For how long have you served in your current position? _____ Years

Section B: use of computer technology

1. As you are aware, MoEST provided infrastructure for ICT while KICD provided digital content to the ESP schools. To what extent would you say the computer technology has been adopted in the ESP schools?

   ---

2. In your opinion what are these ICT infrastructure used for in the school? (probe for learning basic skills, instructional purposes, sources for information)

   ---

3. What has your Institution/ MOE done to ensure there is content and the facility is used for the intended purpose? (probe for content that has been provided and any follow up on its use)

   ---

4. Given that the Ministry provided standard infrastructure to all ESP schools irrespective of number of students, how were schools supposed to cope?

Section C: Contextual factors influencing computer adoption

5. Comment on factors in the school context that enhance or inhibit adoption of the computer technology

Enhance

Inhibit

---

6. Comment on teachers' characteristics that may enhance or inhibit adoption of the computer technology

Enhance

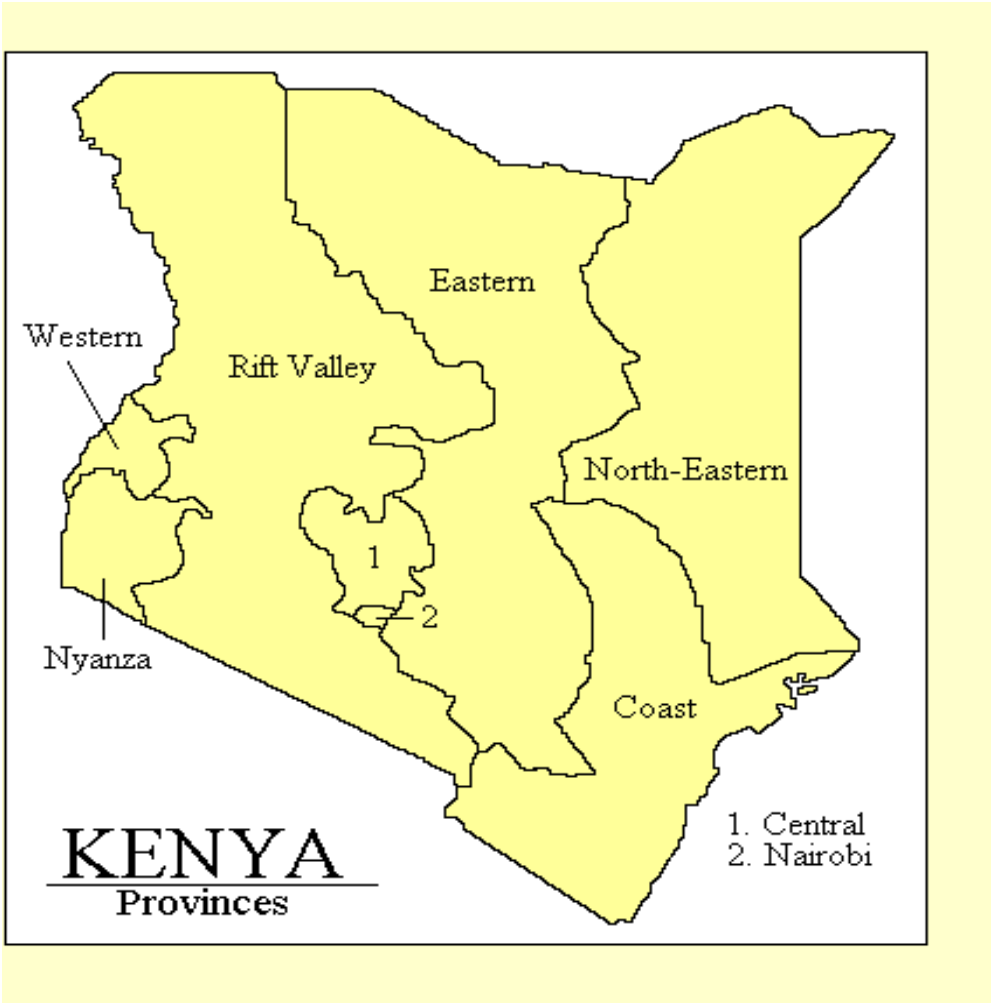
Inhibit

THANK YOU

APPENDIX 3: LIST OF ESP-ICT FUNDED SCHOOLS (2010 – 2011)

Source: MoE, 2011

APPENDIX 4: MAP OF KENYA SHOWING REGIONS USED IN DATA COLLECTION



APPENDIX 5: RESEARCH PERMIT

APPENDIX 6: RESEARCH AUTHORIZATION