FACTORS INFLUENCING INFORMATION COMMUNICATION TECHNOLOGY INTEGRATION IN CURRICULUM IMPLEMENTATION IN SECONDARY SCHOOLS: A CASE OF GILGIL SUB-COUNTY, NAKURU COUNTY - KENYA

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DECLARATION

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

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DEDICATION

This research project is dedicated to my sons Frank and Glen who sacrificed so much so that I could pursue this course. Their inspiration and encouragement which propelled me to the finish line is unforgettable.

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May God bless you all abundantly.

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ABBREVIATIONS & ACRONYMS

CD	-	Compact Disk
DEO	-	District Education Officer
DoE	-	Director of Education
Govt	-	Government
HODs	-	Head of Department
ICT	-	Information and communication technology
IRI	-	Radio for Interactive Radio Instructions
M&E	-	Monitoring and Evaluation
MoE	-	Ministry of Education
MoEST	-	Ministry of Education Science & Technology
NEPAD	-	New Partnership for African Development
PPM	-	Project Planning and Management
PPP	-	Public-Private Partnership
PTRs	-	Pupil Teacher Ratios
ROM	-	Read on Memory
SAS	-	Support Application Systems

ABSTRACT

The principal objective of the existing education policy on ICT is imbedded in three documents namely; e-Government Strategy, National ICT Policy and Sessional Paper No. 1 of 2005, a Policy Framework for Education, Training and Research to integrate ICT in the delivery of education and training curricula. According to policy makers, information and communication technology (ICT) integration takes place when teachers know how to incorporate and use ICT to teach in the classroom. The purpose of this study was to examine factors influencing information communication technology integration in curriculum implementation in secondary schools in Gilgil Sub-County, Kenya. The study sought to determine the influence of availability of ICT infrastructure, teachers' use of ICT infrastructure, teachers' knowledge of ICT and teachers' attitudes towards ICT on ICT integration. The study employed the descriptive research design. The target populations for the study comprised 697 teachers and 49 school principals (total = 756) from the 49 secondary schools in Gilgil Sub-County. A sample size of 254 at a confidence level of 95% and margin of error 5.0%, made up of 25 principals and 229 teaching staff was used. Primary data was collected using the teacher's questionnaire and an interview guide for school principals. Expert opinion by the supervisor was sought for the research instruments to ensure their content validity and reliability tested after the instruments had been pilot-tested on a sample of 20 teachers from 4 schools. The collected data was analyzed with the aid of the Statistical Package for Social Sciences (SPSS) Version 21. Descriptive statistics involving percentages and mean scores were generated to determine varying degrees of response-concentration and regression and correlation analyses conducted to establish whether the independent variables in the study influenced the dependent variable. The study established that most of the schools had computers. The types of computers available in the schools were mainly desktop computers. All the computer-related hardware was either unavailable or largely inadequate in the schools. A significant positive relationship existed between availability of ICT infrastructure and ICT integration in curriculum implementation in secondary schools in Gilgil Sub-County ($r=0.68$, $p<0.05$). On teachers' use of ICT, it was established that on average, teachers used computer software more often than they used the hardware. There was a significant positive relationship between teachers' use of ICT hardware infrastructure and ICT integration in curriculum implementation ($r=0.68$; $p<0.05$) and teachers' use of ICT software infrastructure and ICT integration in curriculum implementation ($r=0.66$; $p<0.05$). Also, there was a significant positive relationship between teachers' knowledge of ICT and ICT integration in curriculum implementation ($r=0.49$; $p<0.05$) and a significant, positive correlation between teachers' attitudes towards ICT and ICT integration in curriculum implementation ($r=0.18$; $p<0.05$). There is therefore need for all the stakeholders in the education sector to join hands in supporting the schools to acquire the requisite ICT infrastructure if the ICT in education Policy (2006) is to be effectively implemented in schools. The study further recommends that teachers be provided with technical assistance because this assistance may provide them with up-to date equipment in the new world of technology. Tteachers should also be given sufficient training on ICT use and integration into teaching and learning processes.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

The potential of information communications technology (ICT) to enhance human capabilities and revolutionize the management of organizations was first realized in other sectors of human society, mostly in the business world and the military, other than in education (Ray & Davis, 1991). The importance of ICT contribution is also widely recognized both in the workplace and at home (Dawes, 2001; Preston *et al.* 2000). These examples are just a few pointers which show that ICT is becoming a vital enabling tool that can no longer be ignored in the running of schools.

The rapid growth in ICT has brought remarkable changes in the twenty-first century, as well as affected the demands of modern societies **(**Buabeng-Andoh, 2012). ICT is becoming increasingly important in our daily lives and in our educational system. Therefore, there is a growing demand on educational institutions to use ICT to teach the skills and knowledge students need for the 21st century. Realizing the effect of ICT on the workplace and everyday life, today's educational institutions try to restructure their educational curricula and classroom facilities, in order to bridge the existing technology gap in teaching and learning **(**Buabeng-Andoh, 2012). This restructuring process requires effective adoption of technologies into existing environment in order to provide learners with knowledge of specific subject areas, to promote meaningful learning and to enhance professional productivity (Tomei, 2005).

Modern technology offers many means of improving teaching and learning in the classroom (Zindi and Ruparanganda, 2011*)*. Technology can play a part in supporting face-to-face teaching and learning in the classroom (Wong *et al.,* 2006). New technologies have the potential to support education across the curriculum and provide opportunities for effective communication between teachers and students in ways that have not been possible before (Dawes, 2001). ICT in education has the potential to be influential in bringing about changes in ways of teaching (Zindi and Ruparanganda, 2011*)*.

The purpose of ICT in the educational curriculum is enhancing the learning process through the interaction of resource materials and the mature minds of the teachers and the course contents of the curriculum (Obunadike, 2009). Many researchers and theorists such as Grabe and Grabe (2007) assert that the use of computers can help students to become knowledgeable, reduce the amount of direct instruction given to them, and give teachers an opportunity to help those students with particular needs. While new technologies can help teachers enhance their pedagogical practice, they can also assist students in their learning (Zindi and Ruparanganda, 2011*)*.

Technology is a channel for helping teachers to communicate better with their learners. But teachers can use technology in their classrooms when they are first and foremost informed and knowledgeable (Doering & Robleyer, 2010). ICT training has an important influence on how well ICT is embraced in the classroom (Baylor and Ritchie, 2002); Tondeur *et al.,* 2008). Meaningful technology integration into pedagogy depends on how teachers plan for and use it in the classroom for effective instructional delivery (Mukuna, 2013), their attitude towards computer use (Demetriadis *et al*., 2003) as well as improper instructional reforms based on improper pedagogical beliefs (Selwyn, Dawes & Mercer, 2001). Teachers' efforts to integrate ICT into the school curricula are often limited by barriers that are either extrinsic to teachers (for example, lack of access to hardware and software and insufficient time to plan ICT-mediated instructions) or fundamentally rooted in teachers' beliefs about teaching and learning or both (Ertmer, 1999; Pelgrum, 2001).

Educational institutions in Kenya in the 21st century, just as in other parts of the world, are increasingly becoming complex multidimensional organizations requiring tremendous input in terms of human, financial and physical resources. Such school working environments are bound to overwhelm the abilities of today's teacher and administrator if they are not aided in the performance of their duties. These developments demand therefore that educational institutions modernize their tools of conducting business to enhance the effectiveness of curriculum implementation.

From early 1990s, increasing numbers of secondary schools in Kenya acquired computers for use in the institutions. The initiative was partly due to pressure from parents, communities and politicians. Some of the computers installed in these schools came in the way of donations (Kavagi, 2001; Scott, 1987). In Kenya like most

developing countries, ICT usage is still limited to computer literacy training. The present ICT curriculum merely deals with 'teaching about computers' and not how computers can be used to transform the teaching and learning in our schools (Muriithi, 2005).

Despite the central role occupied by administration in the schools, for a long time there has been little emphasis on the "effectiveness goals" of ICT in the Kenyan schools. However, since the turn of this century, the Kenyan Government has been working towards the realization of transforming all educational institutions in the country to be ICT compliant as attested by the interest shown on ICT in a number of government policy documents (Republic of Kenya 2005a) and also in the Jubilee Manifesto. Amidst this favourable gesture from the Government of Kenya to embrace ICT, this study therefore was therefore designed to examine factors influencing information communication technology integration in curriculum implementation in secondary schools in Gilgil Sub-County, Kenya

1.2 Statement of the Problem

It is pertinent to note that educational systems worldwide are vigorously pursuing the integration of ICT as a means of keeping abreast with the rapid technological changes associated with a knowledge-based economy. The education system in Kenya is no exception to these emerging pedagogical changes, which have subsequently prompted the government to introduce several e-initiatives related to the integration of ICT in learning and teaching. Due to ICT's importance in society and possibly in the future of education, identifying the possible obstacles to the integration of these technologies in schools would be an important step in improving the quality of teaching and learning. Although educators appear to acknowledge the value of ICT in schools, difficulties continue to be encountered during the processes of adopting these technologies.

Kenya's Ministry of Education's (MoE) ICT option Paper (Republic of Kenya, 2005b) suggests that ICT integration concepts used in the TTC model can be adapted for secondary school teachers and students. The National ICT Policy also recognizes the potentials of ICT in education by emphasizing integration of ICTs in teaching curriculum at all levels of education. In addition, the Ministry of education has a National ICT Strategy for Education and Training of 2006 which highlights the

potential of ICT to help address emerging challenges such as overcrowded classrooms, high Pupil Teacher Ratios (PTRs) particularly in densely populated and semi-arid areas, shortage of teachers on certain subjects or areas, and relatively high cost of learning and teaching materials. However, 8 years down the line, only 44 out of 49 secondary schools in Gilgil Sub-county have initiated the ICT integration where 7 out of the 12 are private schools. This study investigated the factors that influence the integration of Information and Communication Technology (ICT) in implementation of curriculum in Kenyan secondary schools.

1.3 Purpose of the Study

The purpose of this study was to examine factors influencing information communication technology integration in curriculum implementation in secondary schools in Gilgil Sub-County, Kenya

1.4 Objectives of the Study

The study was guided by the following objectives.

1. To establish the extent to which availability of ICT infrastructure influences ICT integration in curriculum implementation in secondary schools in Gilgil Sub-County

2. To determine the extent to which teachers' use of ICT infrastructure influences ICT integration in curriculum implementation in secondary schools in Gilgil Sub-County

3. To establish the extent to which teachers' level of knowledge of ICT influences ICT integration in curriculum implementation in secondary schools in Gilgil Sub-County

4. To determine the extent to which teachers' attitudes towards ICT influences ICT integration in curriculum implementation in secondary schools in Gilgil Sub-County

1.5 Research Questions

The study sought to answer the following research questions

1. To what extent does the availability of ICT infrastructure influence ICT integration in curriculum implementation in secondary schools in Gilgil Sub County?

2. To what extent does teachers' use of ICT infrastructure influence ICT integration in curriculum implementation in secondary schools in Gilgil Sub-County?

3. To what extent does teachers' level of knowledge of ICT influence ICT integration in curriculum implementation in secondary schools in Gilgil Sub-County?

4. To what extent do teachers' attitudes towards ICT influence ICT integration in curriculum implementation in secondary schools in Gilgil Sub-County?

1.6 Significance of the Study

The study's findings provide critical information to the Ministry of Education, stakeholders in the education sector and the school management/administration that broadly enumerates on how availability of ICT infrastructure, teachers' level of knowledge of ICT and attitudes affect ICT integration in curriculum implementation. It is expected that these stakeholders will be in a position to respond and adjust the learning programmes appropriately. Management of secondary schools in Kenya will be able to identify both the challenges they face in ensuring ICT integration in learning and measures of dealing with them in prompting ICT integration in curriculum implementation among their schools. Knowledge gained from this research study would be useful to educators and the Ministry of Education (MoE) in formulating the appropriate ICT policies in line with the National ICT Policy (2006). Theoretically, the study would also prompt more researchers in the area having contributed to literature for future studies.

1.7 Delimitation of the Study

Extant literature reveals that a multitude of factors challenge the integration of ICT in curriculum implementation. However, not all the factors canvassed in the literature may be applicable to the Kenyan situation. Thus, this study examined only the influence of

availability of ICT infrastructure, teachers' use of ICT infrastructure, teachers' knowledge of ICT and teachers' attitudes towards ICT on ICT integration. The study covered only selected schools in Gilgil Sub-county regardless of whether they were public or private. Data was collected from a sample of teachers from the identified schools.

1.8 Limitations of the Study

The study was based on a number of assumptions and hence had several limitations which need to be recognized and perhaps overcome in future research. First, it may not be appropriate for the findings of this study to be made applicable to all the secondary schools in Kenya. However, it is hoped that the study can be reproduced in other geographical locations to test the extent of the applicability of the findings to all the secondary schools in Kenya.

The study collected individual teachers' views of the prevailing situation with regard to the identified factors. It was assumed that the teachers' responses were truthful and honest, reflecting their feelings regarding those factors. It is possible that their feelings about the factors may have resulted from personal rationalization of the factors in the context of their individual understanding of the ideal situation, and may actually not relate to ideal standards of the factors in relation to curriculum implementation.

1.9 Assumptions of the Study

The first assumption of the study was that all the schools had to the largest extent possible implemented the national ICT policy (2006) to allow integration of ICT in curriculum implementation. The second assumption was that there would be maximum cooperation from administrators of the sampled schools and the respondents, and that their responses and opinions would be honest and reflect the actual situation in relation to the study variables. Finally, it was assumed that the study would take place as planned and all the activities accomplished within the budgetary allocations.

1.10 Definition of Significant Terms

The following terms assumed the stated meanings in the context of this study.

Information Technology (IT) - Refers to the study of concepts, skills, processed and applications of design for representing physical, hypothetical or human relationships, created, collected, stored, retrieved, manipulated, protected and presented electronically (Ajagun, 2003).

Information Communication Technology (ICT) - Refers to a whole range of technologies involved in information processing and electronic communications. ICT simply means all that is involved in gathering and processing of information, using modern communication technologies such as computers and other related equipment so that the service (output) generated can reach all that desire them at reasonable cost and in good time to the overall benefit of mankind (Aneakwe, 2008).

ICT Integration – The concept of "integration" is understood differently by those who perceive themselves as "integrating" ICT into the curriculum. In understanding what it means to integrate ICT into the curriculum, it is argued that ICT integration applies across the curriculum, it is not a separate course as others might think (Flanagan & Jacobsen 2003). At the most elementary level integrating of ICT can simply mean using word processing to type school projects and at the most sophisticated level, it can refer to a simulation that would not be possible without computer technology.

Curriculum implementation – Is a process that involves helping the learner, who is the central figure in the process, acquire knowledge or experience.

1.11 Organisation of the Study

This study contains five chapters. Chapter one is the introduction and includes the background information of the study, statement of the Problem, purpose of the study, the research objectives and questions that will guide the study. Also included is the significance of the study, delimitations and limitations of the study as well as the basic assumptions of the study and finally definitions of significant terms used in the study.

Chapter two is the literature review of relevant works done related to ICT integration in curriculum implementation. This chapter generally seeks to identify the gaps in research in factors influencing ICT integration in curriculum implementation in the study location. This chapter also contains the conceptual framework of the study.

Chapter three is a description of the Research Methodology used. The research design and target population is explained. There is also a description of the sample size and sample selection. A description of the research instruments used, their validity and reliability is also included. There is also an elaboration of data collection procedures and the operational definition of variables.

Chapter four includes a presentation of the study findings and their interpretations as well as discussion of the findings, organized according to the four objectives of the study. These findings were related to the literature reviewed in Chapter two.

Chapter five was linked to Chapter 4 in which findings were summarised by deliberating on the themes as viewed from the outcomes of the study. The chapter also contains the conclusions and recommendations of the study and provides suggestions for further research.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter consists of two main sections. The first section is a review of studies carried out by scholars in the field of ICT integration in curriculum implementation. The objective of the section was to identify knowledge gaps in the factors influencing ICT integration in curriculum implementation. The literature review was discussed under sub-sections of availability of ICT infrastructure and ICT integration in curriculum implementation, teachers' knowledge of ICT and ICT integration in curriculum implementation, teachers' attitudes towards ICT and ICT integration in curriculum implementation and ICT integration in curriculum implementation. The second part presents the conceptual framework on which the study was based. The conceptual framework provides the links between the literature, the study objectives and the research questions.

2.2 Availability of ICT Infrastructure and ICT Integration in Curriculum Implementation

Efficient and effective use and integration of technology in curriculum implementation depends on the availability of hardware and software and the equity of access to resources by teachers, students an administrative staff. Inadequate access to technology and not having enough time to access technology to be familiar with it affects teachers' competency and comfort level for ICT use (Divaharan & Ping, 2010). Clearly, if technology cannot be accessed by the teacher, as in so many educational settings in Sub-Saharan Africa, then it will not be used.

Despite a great deal of recent progress and optimism that many more learners can benefit from access to ICT, the infrastructures necessary for deploying technological resources are lacking in low-income countries (Hennessy, Harrison & Wamakote, 2010). Schools have to be equipped with the necessary ICT infrastructure in order to provide the next generations with the needed tools and resources for access and use and to attain the expected skills (Gulbahar & Guven 2008). This view is shared by Afshari (2009), that schools are equipped with different kinds of technological infrastructure

and electronic resources including hardware, software and network infrastructure which must be available to integrate ICT in education. He further argues that limited access to computers is a barrier to effectively using computers in classes.

Bingimlas (2009) identified the major barriers that teachers encountered in integrating ICT into education to be lack of access to resources, lack of confidence and lack of competence. Wastiau *et. al.* (2013) noted that school heads and teachers considered that insufficient ICT equipment (especially interactive white boards and laptops) was the major obstacle to ICT use in Europe. According to Mukuna (2013), sustainable integration of ICTs into pedagogical practices needed access to hardware, software and other resources. Similarly, Ozden (2007), Afshari (2009) and Mumtaz (2000) identified lack of computer facilities or insufficient appropriate software and related information, and an insufficient budget to support use of technology as obstacles to integration of ICTs. One of the reasons for this is the high costs associated with hardware and software.

Kenya data profile (2006) indicates that most secondary schools have some computer equipment. However, this could consist of one computer in the office of the Head teacher. The profile also points out that very few secondary schools have sufficient ICT tools for teachers and students. Further, it was observed that even in schools that have computers, the student-computer ratio is 150:1 (Kenya data profile, 2006). The other major problem pointed out by the Data and Statistics (2006) was that Kenya lacked adequate connectivity and network infrastructure. It was pointed out that, although a small number of schools had direct access to high speed connectivity through an internet service provider, generally there was limited penetration of the national physical telecommunication infrastructure into rural and low-income areas. Notably, given that the conditions above are described as they were in 2006, it is likely that with the effort made by the government toward preparation for introduction of e-learning in schools, things have improved. To this extent, it was important to investigate the availability of ICT infrastructure in the secondary schools in Gilgil Sub-County and how such availability influences ICT integration in curriculum implementation in the Sub-County.

2.3 Teachers' Use of ICT Infrastructure and ICT Integration in Curriculum Implementation

Three objectives are distinguished for the use of ICT in education (Plomp, Ten Brummelhuis, & Rapmund, 1996): the use of ICT as object of study, the use of ICT as aspect of a discipline or profession; and the use of ICT as medium for teaching and learning. The use of ICT in education as object refers to learning about ICT, which enables students to use ICT in their daily life. The use of ICT as aspect refers to the development of ICT skills for professional or vocational purposes. The use of ICT as medium focuses on the use of ICT for the enhancement of the teaching and learning process (Drent & Meelissen, 2007). It is a fact that teachers are at the center of curriculum change and they control the teaching and learning process. Although ICT may facilitate independent self-paced learning, the potential of ICT may not be optimized if there is no shift in the learning and teaching paradigm (Bangkok, 2004). In fact, teachers play an important role in the teaching/learning paradigm shift. They must understand the potential role of technology in education. Also, they should become effective agents to be able to make use of technology in the classroom.

The educators' use of ICT and subsequent integration of technology into their teaching and learning is dependent on a number of factors. Such factors include teachers' readiness, confidence, knowledge and ability to evaluate the role of ICT in teaching and learning, and lack of skills to be able to use the ICT equipment (Manson, 2000; Lau & Sim, 2008). In most cases, the shortcomings result in lack of confidence among teachers in utilizing ICT in curriculum delivery (Tella, Tella, Toyobo, Adika & Odeyinka, 2007). Lau and Sim (2008) show that, despite the apparent benefits of the use of ICT for educational purposes, the learning potential of ICT is deprived as many teachers are still not fully ICT-literate and do not use it in their teaching. It may be argued that technology provides the educators with a limited set of potential functioning due to insufficient ICT training they have received.

According to Flanagan and Jacobsen (2003), technology integration is meant to be cross-curricular rather than become a separate course or topic in itself. Technology should be used as a tool to support the educational objectives such as skills for searching and assessing information, cooperation, communication and problem solving which are important for the preparation of children for the knowledge society (Drent &

Meelissen 2007). In fact, innovative use of ICT can facilitate student centered learning (Drent, 2005). Hence, every classroom teacher should use learning technologies to enhance their student learning in every subject because it can engage the thinking, decision making, problem solving and reasoning behaviors of students (Grabe & Grabe, 2001).

Slaouti and Barton (2007) have shown that hurdles such as access to equipment, time pressures, lack of mentors and opportunities for apprenticeship have an impact on educators' ability to utilize ICT in teaching and learning. Cox *et al* (1999) argue that some educators do not use ICT in their teaching because they (the educators) are computer-phobic. Some of the causes of the phobia are: psychological factors e.g. having little or no control over the activity, thinking that they might damage the computer, and feeling that one's self-esteem is threatened; sociological factors such as ICT being regarded as a solitary activity, the perception that one needs to be clever to use one, and the fear of being replaced by the computer; and operational factors such as the technology being beyond one's abilities, having to cope with unfriendly jargon, and the likelihood of the technology going wrong (Cox *et al*, 1999).

Research has shown that teachers' attitudes towards technology influence their acceptance of the usefulness of technology and its integration into teaching, Huang & Liaw (2005). In European Schoolnet (2010) survey on teachers' use of Acer netbooks involving six European Union countries, a large number of participants believed that the use of netbook had had positive impact on their learning, promoted individualized learning and helped to lengthen study beyond school day. However, evidence suggests that small number of teachers believe that the benefits of ICT are not clearly seen. The Empirical survey revealed that a fifth of European teachers believed that the use of ICT in teaching did not benefit their students' learning, Korte & Hüsing (2007). A survey of UK teachers also revealed that teachers' positivity about the possible contributions of ICT was moderated as they became 'rather more ambivalent and sometimes doubtful' about 'specific, current advantages', Becta (2008).

2.4 Teachers' Knowledge of ICT and ICT Integration in Curriculum Implementation

The teacher is responsible for establishing the classroom environment and preparing the learning opportunities that facilitate students' use of technology to learn and communicate (UNESCO 2008). Thus, the changing landscape of communications and information exchange in the 21st century requires teachers to be at the cutting edge of knowledge production, modification and application rather than consumption. They need to be prepared for this by being educated to use ICT effectively and creatively. In many developing countries, however, most teachers have minimal or no ICT skills themselves and therefore cannot develop these in learners. Two of the most important supports for ICT integration into teaching and learning are effective Initial Teacher Education (ITE) and Continuing Professional Development (CPD). Both have the greatest impact on the beliefs and practice of teachers, and yet professional development time in particular is often not budgeted for (Venezky, 2004).

Research finding have revealed that most teacher training courses focus on basic computer operations rather than advanced computer skills and subject-specific pedagogical applications (Tin 2002). Studies on teacher learning in Northern hemisphere contexts suggest that traditional, one-off external in-service workshops tend to be of limited value in developing sustained transformation of practice (Glazer & Hannafin, 2006; Muijs & Lindsay, 2008). A growing body of research shows that a more promising way forward is a sustained professional development programme that draws on teachers' local professional communities, encourages ongoing peer learning by teachers of similar subjects and age groups and supports reflective classroom practice (Bowker, Hennessy, Dawes, & Deaney, 2009; Zwart, Wubbels, Bergen, & Bolhuis, 2007).

In many African countries, lack of well trained teachers and low levels of teachers' ICT skill and knowledge has been recognized as major obstacle in implementation of ICT in schools (Dzidonu, 2010; Hennessy, Harrison & Wamakote, 2010). Indeed it has been observed by many that meeting the desperate need for more qualified, competent teachers is the most persistent and daunting challenge facing the African education system in general, and the integration of ICT in particular (Olakulehin, 2007). Yet, for efficient implementation of ICT in schools, there should be adequate personnel that

have correct skills. Where such skills are missing, it would be difficult to fully implement the technology in schools. In response to this critical need, governments in sub-Saharan Africa, as elsewhere, are emphasizing teacher development as the key to effectively implementing policy and curricula, to using ICT to enhance teaching and learning, and to raising educational standards.

A study by Higgins, & Moseley, (2011) revealed that inability of teachers to understand why they should implement ICT in teaching and how exactly to implement was an impediment to its implementation. Unfortunately, many teachers' training institutions in Africa continue to teach more about what is ICT rather than teaching how to use it during teaching and learning in classroom. In addition, in-service courses for subject teachers already in the profession should be developed that will guide them on how to use ICT during teaching and offer them basic skills needed for its implementation. Many authors believe that a continued professional development of teachers can help to successfully implement ICT in schools (Higgins & Moseley, (2011), Dzidonu, 2010). A promising way forward should be a sustained professional development that draws on teachers local professional capabilities, supports reflective classroom performance, and encourages peer learning by teachers of same age group and similar subjects. Teachers need to become constant learners, while teaching and even learning from students.

Mukuna (2013), notes that there have been several curriculum changes in Kenya in the past that often takes too long to be implemented. The main reason most researchers give is resistance by teachers to implement the new curriculum, which is exacerbated by incompetence of teachers and lack of training prior to introduction of the new curriculum. Insufficient ICT knowledge or lack of competence by teachers may give rise to the reluctance or being anxious to use ICT in teaching (Bingimlas, 2009; Mumtaz, 2000; Balanskat *et al.*, 2006). Kinuthia (2009) notes that few teachers in the school system in Kenya are not computer literate and even fewer teachers can competently use a computer as a teaching resource or a tool for instruction. All efforts towards integrating ICT in the curriculum must be comprehensive enough to prepare teachers adequately to use it effectively. Pre service training should have a component of integration of ICTs into the classroom practices. Schools must have a plan for continuous professional development for teachers, administrators, technicians, not only to learn the latest technology, but more importantly the most effective pedagogy related

to integrating the technology into the classroom (Mukuna, 2013). It is not clear the extent to which teachers in Gilgil Sub-County have the requisite ICT knowledge and skills to integrate ICT in curriculum implementation. This made it imperative to establish the level of knowledge of ICT possessed by the teachers and further establish how this knowledge influences ICT integration in curriculum implementation in the Sub-County

2.5 Teachers' Attitudes Towards ICT and ICT Integration in Curriculum Implementation

Successful integration of ICT in the school environment is to a large extent influenced by the attitude held by the implementers. Teacher beliefs or perceptions have been identified as a 'second-order' barrier to the integration of ICT in teaching and learning (Ertmer, 2005). Research studies have shown that effective use of computers is dependent on the teachers' intentions, personal beliefs and attitudes towards teaching with technology and ICT use (Divaharan & Ping, 2010; Özden, (2007). Teachers' attitudes to change are important because teachers' beliefs influence what they do in classrooms. Becta (2004) claims that one key area of teachers' attitudes towards the use of technologies is their understanding of how these technologies will benefit their teaching and their students' learning. It is believed that if teachers perceived technology programs as neither fulfilling their needs nor their students' needs, it is likely that they will not integrate the technology into their teaching and learning. Research has shown that teachers' attitudes towards technology influence their acceptance of the usefulness of technology and its integration into teaching. Teachers' computer experience relates positively to their computer attitudes. The more experience teachers have with computers, the more likely that they will show positive attitudes towards computers (Buabeng-Andoh, 2012). Many teachers have been found to offer stiff resistance to change involving technology intervention, technology integration and technology incorporation (Albirini 2007).

Research and active development projects such as those run by EdQual, a Research Consortium of educational institutions in the UK and Africa (Ghana, Rwanda, South Africa and Tanzania) on Educational Quality typically indicate two main reasons why teachers use ICT. Firstly, they feel that their own use of computers benefits their learners, and secondly, teachers feel learners benefit from using computers themselves.

Teachers see ICT as kindling students' interest and learning in the subject. ICT promotes a positive attitude towards information technology as an essential part of a lifelong interest in learning. Teachers also perceive the use of ICT as enhancing recall of previous learning, providing new stimuli, activating the learner's response, and providing systematic and steady feedback. It is further perceived as sequencing learning appropriately, and providing access to a rich source of information. For example, Tella *et al*. (2007) found that computer use by teachers was driven by intentions to use it, and that perceived usefulness was also strongly linked to those intentions. The implication is that teachers will be inclined to use technology if they perceive it to be useful. Furthermore, ICT needs to be linked to specific needs of learners, desisting from the "one size fits all" approach (Leach, 2005). It is most effectively used as a learner-centred tool, instead of within a more traditional pedagogy. The real challenge for educationists is, therefore, how to harness the potential of ICT to complement the role of a teacher in the teaching and learning process. There is an understandable apprehension, even fear, as to the role of a teacher in an ICT-equipped classroom (Futurelab, 2003). Teachers who lack the chance to develop professionally in the use of modern ICT feel under threat. The relevance of a teacher in the 21st century is determined by their willingness to develop in this way.

Personal characteristics such as educational level, age, gender, educational experience, experience with the computer for educational purpose and attitude towards computers can influence the adoption of a technology (Buabeng-Andoh, 2012). The attitudes of teachers towards technology greatly influence their adoption and integration of computers into their teaching. Anxiety, lack of confidence and competence and fear often implies ICT takes a back seat to conventional learning mechanisms (Buabeng-Andoh, 2012; Hennessy *et. al.*, 2010). However, factors such as a student–oriented pedagogical approach, a positive ICT attitude, computer experience, and personal entrepreneurship of the teacher educator have a direct positive influence on the innovative use of ICT by the teacher (Afshari *et. al.*, 2009). Teachers are likely to plan and implement practices with technologies that reflect their beliefs about teaching and learning (Grainger and Tolhurst, 2005).

According to Sang *et al*. (2009) and Zhao & Cziko (2001), teachers' educational beliefs impact on their use of ICT. This was the result of a quantitative survey conducted by

Sang *et al.* (2009) on 873 primary school teachers from 11 Chinese provinces and municipalities, and of a literature survey by Zhao & Cziko (2001). The same study by Sang *et al.* (2009) which also identifies attitude and motivation as factors influencing the adoption of ICT is supported by the results of a study conducted by Kumar *et al.* (2008). Tella *et al.*, (2007) examined Nigerian secondary school teachers' uses of ICTs and implications for further development of ICT use in schools using a census of 700 teachers. The findings showed that most teachers perceived ICT as very useful and as making teaching and learning easier.

Negative attitude towards e-learning among students and teachers was found to be the key obstacle to the successful implementation of e-Learning projects in the NEPAD schools in Kenya (Lumumba, 2007). In his study, Gakuu (2006) points out that Principals' attitude towards the adoption of e-Learning in Secondary schools is a critical issue that needs consideration and investigation for successful implementation of the new e-Learning initiative. Gakuu maintains that as the head of the institution, the principals hold a very strategic position in influencing the decisions and the actions of other members of the school community. For example, the attitude that the Principals hold towards ICT (e-Learning) adoption in secondary schools will greatly affect the teachers and by extension, students' attitudes, decision and actions towards e-Learning initiatives. Teachers are expected to carry out the implementation process and unless they have a positive attitude, it will be a serious obstacle to the implementation. Lumumba (2007) points out that it is not in doubt that the involvement of teachers is instrumental in unlocking potential gains which e-learning could offer to the learners, but teachers' negative attitude towards the use of e-learning will greatly limit the learners' chance of benefiting from e-learning.

2.6 ICT Integration in Curriculum Implementation

The concept of "integration" is understood differently by those who perceive themselves as "integrating" ICT into the curriculum. In understanding what it means to integrate ICT into the curriculum, it is argued that ICT integration applies across the curriculum, it is not a separate course as others might think (Flanagan & Jacobsen 2003). At the most elementary level integrating of ICT can simply mean using word processing to type school projects and at the most sophisticated level, "integrating" ICT can refer to a simulation that would not be possible without computer technology.

However the definition alone does not clarify what it means to integrate ICT across the curriculum. Further examination is needed to clarify how schools can integrate ICT into the curriculum.

Means and Olson (1997) and Ertmer (1999) define ICT integration as the use of technology to promote students' learning by challenging them with complex and authentic tasks and learning, in a collaborative environment where ICT furnishes students with information to support their inquiry and investigation process. The emphasis is on the learning context and ICT integration should be analysed in the context in which it is being integrated (Divaharan and Ping, 2010). ICT integration takes place when teachers know how to incorporate and use ICT to teach in the classroom (Cuban, Kirkpatrick & Peck, 2001; Ertmer, 1999). Dias's (1999) alternative view to ICT integration is that it should be used in a seamless manner as part of the daily learning process that takes place in classrooms.

Lim (2007) notes that ICT integration is interpreted as ICT functioning as an integral or mediated tool to accomplish specific teaching or learning activities to meet certain instructional objectives. For ICT to be effectively integrated in schools, it should be used as a mediational tool in these activities to engage students in higher-order thinking (Lim, 2007). Higher-order thinking skills are "goal-directed, multi-step, strategic processes such as designing, decision making, and problem solving" that require analyzing, evaluating, connecting, imagining, elaborating, and synthesizing, and engagement. This entails mindfulness, cognitive effort, and attention of the students in the learning environment (Kearsley & Shneiderman, 1998; Lim, 2007).

Integrating ICT into the curriculum encompasses a range of approaches that different school teachers use to integrate ICT into their school curricula. Omwenga (2004) regards computer integration in the classroom as the application of technology to assist, enhance, and extend student knowledge. Using ICT in education means more than simply teaching learners how to use computers. Technology is a means for improving education and not an end in itself (Omwenga, 2004). Thus, ICT should also be used to promote information literacy – the ability to access, use and evaluate information from different sources in order to enhance learning, solve problems and generate new knowledge. Integration should consider learning pedagogy, the pattern of student use of ICT, and the extent of use in teaching and learning programmes (Muriithi, 2005).

Research studies in education have shown that information and communication technologies (ICT) coupled with the necessary pedagogical strategies engage students in higher-order thinking (Jonassen & Carr, 2000; Kearney & Treagust, 2001; Oliver & Hannafin, 2000; Lim, 2007). The primary motivation for integrating ICT in education is the belief that it supports students in their own constructive thinking, allows them to transcend their cognitive limitations, and engages them in cognitive operations that they may not have been capable of otherwise (Salomon, 1993).

2.7 Theoretical Framework of the Study

Bottino (2004) outlines three models for integrating ICT into the Curriculum. They include the Transmission model, Learner centred model and the Participative model. The transmission model is nothing else but the drill-and-practice programs that are used to assist learners with development of limited abilities together with tutorial systems that substitute teachers as transmitters of knowledge. The learner centred model is based on the interest that learners learn more when given the opportunity to explore and discover concepts on their own. This means considering active exploration and personal construction of knowledge rather than acquisition of knowledge. Lastly, the participative model is where learning activities are organised to take place in a social environment (Bottino, 2004). Bottino confirms the relationship between the learning principles and the use of computers in the classroom in all the models.

In studying the relationship between ICT and pedagogy McCormick and Scrimshaw (2001) suggested that ICT integration takes place through three levels of pedagogical change: improving efficiency and effectiveness; extending the reach of teaching and learning with ICT; and transforming the concept of the subject with ICT. Improving efficiency with the use of ICT helps teachers to improve their practice by providing the teacher with accurate and efficient tools. These include use of spreadsheets to plot graphs and word processing for writing compositions. Extending the reach of teaching and learning with ICT refers to the use of Internet that enables teachers to extend the resources found in the teaching environment. This provides opportunity for both the teacher and the learner to search for worldwide up-to-date information. However the teacher should monitor the searching process by educating learners on how to use Internet for them to research an agreed question.

During the level of transforming concept of the subject with ICT, teachers support learners to develop a sense of independence through the use of ICT. Learners are free to explore and interact with all sorts of data on their own. The teachers' role is to develop learners' judgment skills and their ability to appraise critically what is of particular importance (McCormick and Scrimshaw, 2001).

Bialobzerska and Cohen (2005) suggested three levels under which ICT can be integrated, the first being functional practice where computers are used to assist in tasks that can be done by other means such as being hand written, which includes use of spreadsheets and word processing. The second, integrative practice is when teachers begin to make use of the computer in a way that learners could benefit the learner, that is, when learners are asked to write compositions using the computer, they use editing tools to check grammar mistakes, spelling mistakes and more appropriate words. The teacher expects learners to draft and redraft and by doing so new insight is gained. The third, transformational practice is the level that considers learning which occurs as a result of activities and opportunities which do not exist in computer less environments. This includes the use of communicating tools whereby learners interact with learners from other countries (Bialobzerska and Cohen, 2005).

A UNESCO study of 2003 outlined four stages of ICT integration within school environment. These included Emerging, Applying, Infusing and Transforming. Emerging stage is evident when the school is in possession of few computers that can be used only by teachers and the administration. During this stage teachers are learning how to use computers. The purpose of this stage is to familiarise teachers with ICT literacy skills. Teachers are trained to use variety of tools and applications. Teachers begin to understand why they have to apply ICTs into their teaching (UNESCO 2003). The major aim is to develop teachers in order for them to feel comfortable and at ease with the application programs and confident in their use (Becta, 2005). The Applying stage is evident when teachers feel reasonably confident with ICT applications. They can use application software and communication tool and browse the Internet confidently (ibid).

Teachers are ready to implement or apply new technologies in the teaching of LAs. Teachers decide why, when, where and how ICT tools will contribute in the objective of the lesson. Teachers should then be able to choose the appropriate ICT tool that will

benefit the learner in understanding the new concepts of the new lesson. This includes being able to choose when the whole class or group multimedia presentations will be useful. It is also important for teachers to understand when and how they will assist learners to find, compare and analyse information from the Internet or from any other research source specific to the LA. At this stage not only teachers are applying ICT's in teaching, the management, secretaries as well as librarians are beginning to apply ICTs in administering their tasks (UNESCO 2003).

The Infusing stage is noticeable when teachers begin to use all what they have learnt in every aspect of their teaching. ICT is incorporated in lesson preparation and management. What becomes critical is for teachers to explore the use of ICTs and to be creative. Through their creativity they are able to stimulate and manage learning of learners using different learning styles to achieve their goals. Transforming stage is visible when teachers use ICT tools with confidence. They are able to apply them in their teaching as well as in other aspects of their teaching. At the stage of transformation the focus changes from being centred on the teacher. The integration of ICT takes a new phase where the process of integrating ICT tools is no longer manipulated by the teacher. Teachers cease to be drivers and repositories of ICT related knowledge. Learners are actively involved in the ICT activities and teachers assist and guide their learners during the process of constructing knowledge. Collaborative skills are developed. Learners work as groups in solving real life problems. They also work with other learning groups from other places using communicating tools by accessing resources on the Internet. Because of the change in learning style, teachers change their assessment strategies (UNESCO, 2003).

Using a slightly different conceptual framework, Yuen, Law and Wong (2003) suggested three models of ICT integration, namely Technological adoption, Catalytic integration and Cultural innovation. At the Technological adoption model stage, the school looks at the adoption of technological infrastructure, formulating organisational structure and teacher technical skills. The teachers' concern is to be able to use computers effectively for the production of documents that can help them in presentation and evaluation of their lessons. At this stage the management is actively involved in the facilitation of technology adoption by teachers. They set targets and timetable for achieving specific ICT competencies. It is mentioned that at this stage the

key element is to enhance teaching by stimulating learners interests with the use of multimedia in teaching.

Learners' involvement is limited, therefore technology adoption cannot be classified as a stage implementing effective integration of ICT, it is still a learning curve for knowledgeable teachers to help other teachers master computer skills and gain confidence. Catalytic integration model stage is where the integration of ICT is an integral part of both teaching and learning. Learners, as well as teachers explore the use of ICT in the teaching and learning process. Teachers are able to design activities that are problem based, task based and underpinned by a social constructivist approach. It is through interacting with problem based activities that learners get maximum control of their learning (Yuen, Law & Wong, 2003).

The Cultural innovation model refers to schools where there is no conflict with infrastructure and teacher development. ICT is treated as part of the school mission and vision. There is multiple leadership style, which means that the principal does not bother much about monitoring the use of ICT as the teachers are free to use ICT according to their beliefs. This means they integrate ICT into the curriculum when they feel the use of the tool will benefit the lesson. Teachers do more than just integrating ICT in their teaching; they develop ICT packages that can be used by other school teachers. There are no formal teacher development sessions. Teachers empower one another in informal setting through information sharing. Learners are free to explore the use of ICT in different aspects of learning such as in extracurricular lessons (Yuen, Law & Wong, 2003). Table 2.1 illustrates how the models of Yuen, Law and Wong (2003) and UNESCO (2003) differ and indicates the stages that the researcher proposes to use in the analysis of the data in this study.

Table 2.1: UNESCO and Yuen, Law & Wong's models and the Researcher's proposed stages

UNESCO (2003)	Yuen, Law & Wong (2003)	Proposed stages
Emerging	Technology	Emerging
Applying	Adoption	Applying
Infusing	Catalytic	Infusing
Transforming	Cultural	Innovating

Looking at Yuen, Law & Wong's (2003) model, it would seem that their technological adoption model conflates the emerging and applying phases suggested by UNESCO (2003). The effectiveness of this approach is obscure since the phase does not specify how long the training of teachers will take before they start implementing ICT in their subjects.

2.8 Conceptual Framework of the Study

The conceptual framework of the study shows the relationship between the independent variables of the study (factors that influence ICT integration in curriculum implementation) and the dependent variable (ICT integration in curriculum implementation). Many factors that influence ICT integration in curriculum implementation have been identified in the extant literature. However, this study focused on four factors, namely: availability of ICT infrastructure in the school, teachers' use of the ICT infrastructure in curriculum delivery, teachers' level of knowledge of ICT and teachers' attitudes towards ICT. Figure 1 shows the conceptual framework of the study.

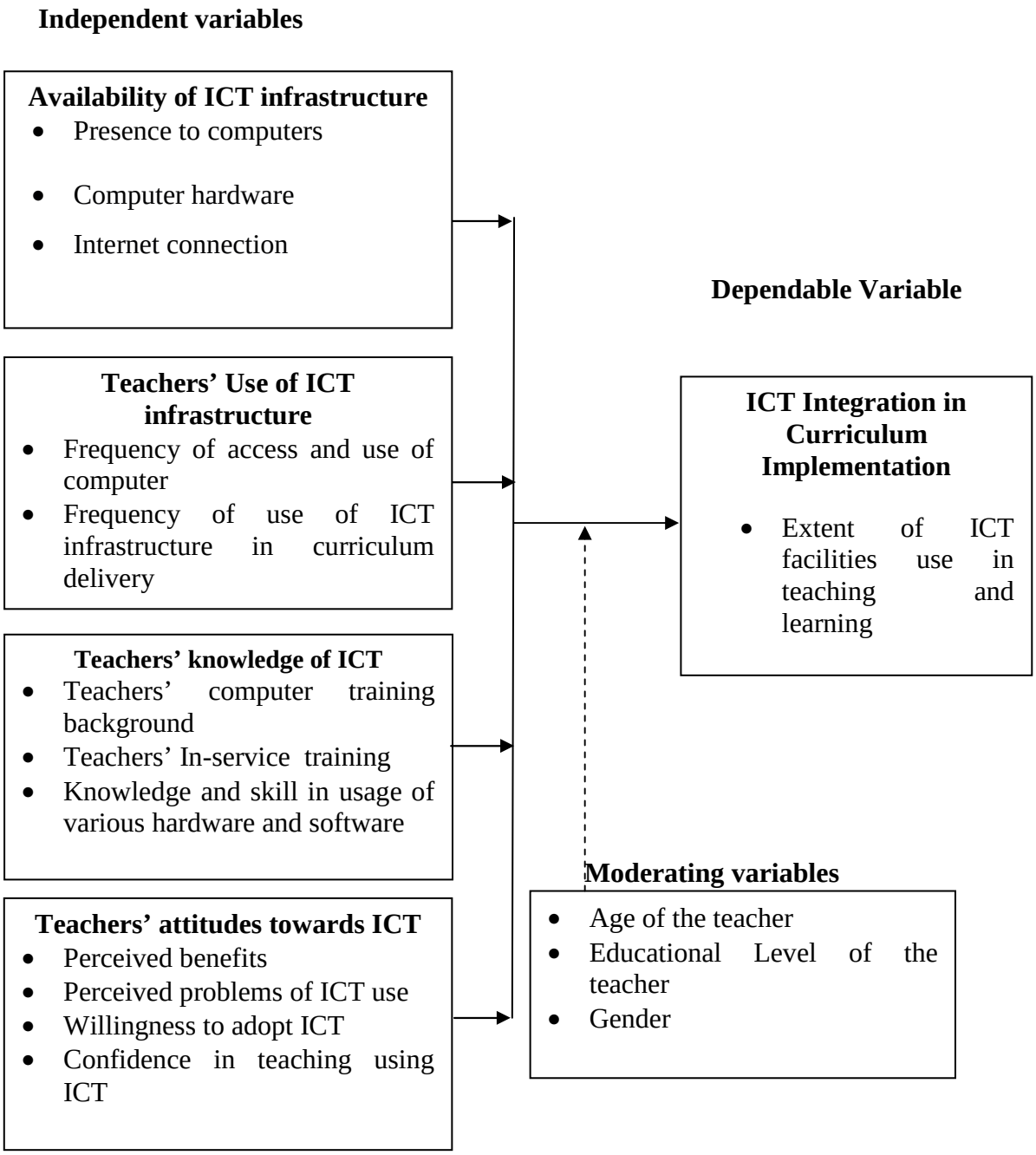

Figure 1: Conceptual Framework of the Study

Availability of ICT infrastructure was conceptualized to constitute presence and access by teachers to computers, computer hardware and software as well as telecommunications infrastructure in the schools. Although these ICT infrastructures may be available in the school, successful integration in curriculum implementation depends on the teachers' actual use of the ICT facilities. This means that spite of availability of the ICT facilities, teachers may not necessarily make use of them. Thus,

it became imperative to investigate whether they make use of the facilities in classroom delivery of curriculum or not, and how this use influenced ICT integration in curriculum implantation. On the other hand, to effectively make use of the ICT infrastructure, teachers must possess the necessary knowledge and skills acquired from their background training, in-service training among other forms of training and perfected through frequent usage of related hardware and software. The ultimate decision to use or not to use ICT in teaching depends on teachers' attitudes towards ICT which are shaped by perceived benefits and/or problems of ICT use, willingness to adopt ICT and their inherent confidence in teaching using ICT.

It was hypothesized that optimal existence of each of the four independent variables/factors would have positive influence on ICT integration in curriculum implementation in secondary schools in Gilgil Sub-County.

2.9 Knowledge Gap

Literature review showed that there was limited information on factors influencing ICT integration in Curriculum implementation in Secondary Schools, particularly in Gilgil Sub-County. The literature also revealed different options that could he considered in order to integrate ICT into Curriculum implementation in Secondary Schools. The researcher identified and highlighted the gap in integration that existed in Curriculum implementation of ICT in Gilgil Sub-County Secondary Schools, which this study sought to close.

2.10 Summary of Literature Review

In the preceding sections, literature related to the study was discussed under the four specific objective areas of the study, namely: availability of ICT infrastructure in the schools, teachers' use of ICT infrastructure, teachers' knowledge of ICT and teachers' attitudes towards ICT and their relationships with ICT integration in curriculum implementation in schools. Whereas the extant literature suggested that the identified factors were correlates of ICT integration in curriculum implementation, there was no empirical evidence that would facilitate generalization of the findings of the reviewed studies to the secondary school system in Kenya. Moreover, the influence of these factors on ICT integration in Gilgil Sub-County remained largely untested, a gap that rent relevance to this study.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter describes the research methodology that was followed in executing the research study. Specifically, the chapter is discussed under sub-sections, namely: research design; target population; sample size and sampling procedures; data collection methods; pilot study and instrument validity and reliability; data collection procedures; data analysis and presentation. Ethical issues which describe the process of involvement of participants in the study and how participants were handled throughout the research process are also outlined.

3.2 Research Design

The study adopted the descriptive survey research design to determine whether the independent variables significantly influenced the dependent variable and to ascertain any association between these variables. Kombo and Tromp (2006) recommend the use of this design when investigating peoples' attitudes and views as they are, without manipulating the variables. Morris and Wood (1991) acknowledge the importance of descriptive survey design especially when the intent is gaining broader understanding of the context of the research and processes being enacted. Moreover, they argue that the design has considerable ability to generate answers to the questions of "why?", "what?" and "how?"

A research design provides a framework for the collection and analysis of data. According to Neuman (2010), the type of research design is generally determined by the purpose of a study, which can be to explore a new area, to describe a particular situation or to explain why something occurs (Babbie, 2010). To this end, Mouton (2005) identifies three types of research design, namely; exploratory (emphasizes discovery of ideas and insights), descriptive (concerned with determining the frequency with which an event occurs or relationship between variables), casual (this is concerned with determining the cause and effect relationships). This categorization indicates that the selection of a research design is not arbitrary but is determined by the nature of the

research problem and the degree of uncertainty surrounding it hence the choice of the descriptive survey research design for this study.

3.3 Target Population

Mugenda and Mugenda (1999) define target population as that population to which a researcher wants to generalize the results of the study. The ideal setting for research study is one that directly satisfies the researcher's interest and should be accessible to the researcher (Singleton, 1993). Therefore, the target population for the study comprised 697 teachers and 49 school principals (total = 756) from the 49 secondary schools in Gilgil Sub-County. This was used as the sampling frame from which a representative sample of schools was selected and a sample of respondents drawn and used for study.

3.4 Sample Size and Sample Selection

This section describes the sample size and procedures used in picking the sampled items for the study.

3.4.1 Sample Size

The unit of sampling for the study was the school. A sample of secondary schools from the study location was constituted at a sampling ratio of 0.5 to obtain 25 schools. Based on the Krejcie and Morgan's table of determining sample size (Appendix V), at a confidence level of 95% and margin of error 5.0%, a population of 756 teachers gave a sample size of 254. This sample size included 25 school principals and 229 teaching staff.

3.4.2 Sample Selection

Multi-stage sampling techniques involving simple random, purposive and proportionate to size sampling were adopted in arriving at the study sample. Simple random sampling was used to objectively select a sample of 25 secondary schools by applying the sampling ratio of 0.5 across the three zones of the Sub-County, namely; Karunga, Mbaruk and Elementaita. In random sampling procedure, all subjects have equal chances of being selected (Joan, 2009). At the school level, all the principals of the 25 sampled schools were automatically included in the study. However, the 229 teaching

staff were selected using probability proportionate to size techniques based on the population of teachers in each of the participating school and in relation to the sub-sample size for each zone.

3.5 Research Instruments

The study's deductions were pegged on mainly primary data. The primary data was collected using the teachers' questionnaire for the teaching staff and an interview guide for school principals. The use of questionnaires made each respondent respond to the same set of questions thus providing an efficient way of collecting responses from a large sample prior to quantitative analysis (Dillman, 2000). On the other hand, in-depth interviews with the school principals helped the study to gather valid and reliable data that was relevant for clarifications.

The questionnaire contained six sections: Section A contained the respondent's demographic information, Section B contained items that collected data on the availability of ICT infrastructure, Section C contained items related to teachers' use of ICT infrastructure, Section D measured teachers' level of knowledge of ICT, Section E tested teachers' attitudes towards ICT and Section F contained items that were used to determine the level of ICT integration in curriculum implementation.

One advantage of the questionnaire is that they are relatively inexpensive in getting information quickly from large samples, as they can be administered by a single researcher on a single occasion, which cuts down on travelling expenses (Oppenheim, 1966; McMillan & Schumacher, 1993). However, the problem with questionnaires is that they do not allow for probing, so the researcher cannot explore any of the answers in more detail. This denies researchers the type of data that gives research its richness and value (Gall *et al*., 1996; Opie, 2004).

3.5.1 Validity of Research Instruments

Validity indicates the degree to which an instrument measures the construct under investigation (Borg and Gall, 1989). There are three types of construct validity tests; content, criterion-related and construct validity. The study utilized content validity because it measures the degree to which the sample of test items represent and the content that task is designed to measure. The instrument was given to the supervisor for

review and to ensure that expert judgment was given, thus ascertainment of construct validity. To ensure that the instrument actually measured what it was intended to measure, the questionnaire was pilot-tested. A small sample of 20 teachers from 4 schools in Gilgil Sub-County was used for this purpose. The subjects were encouraged to make comments and suggestions concerning the instructions, clarity of questions asked and their relevance (Mugenda and Mugenda, 1999).

3.5.2 Reliability of Research Instruments

Reliability of a research instrument is a measure of its internal consistency or stability over time (Borg and Gall, 1989). A measuring instrument is reliable if it provides consistent results. The split-half technique was used to test reliability of the questionnaire. Roscoe, (1969) points out that the split-half technique involves splitting the statements of a test into two levels, odds and even items then calculating the Pearson's correlation coefficient (r) between the scores.

3.6 Data Collection Procedures

The researcher first obtained approval to proceed with data collection from the Graduate school at of the University of Nairobi. A research permit was then sought from the National Council for Science and Technology and permission to collect data from the sampled schools secured from the County Education Office. Data was collected from sampled schools during normal school days. The researcher administered the questionnaire to the teacher respondents, explained the purpose of the study to the respondents and allowed them some time to complete the questionnaire items before collecting them on the same day. This ensured maximum return rate for the questionnaire. The researcher then met the school principals in their respective schools after making appointment with them and held in-depth interviews with them. The filling of the questionnaire was school-based, that is, done in each school at a time.

3.7 Data Analysis

The researcher examined the collected quantitative data to make inferences through a series of operations involving editing to eliminate inconsistencies, classification on the basis of similarity and tabulation to relate variables. Subsequently, the refined data was analyzed using descriptive statistics involving frequencies, percentages and mean

scores to determine varying degrees of response-concentration. Statistics were generated with the aid of the Statistical Package for Social Scientists (SPSS) Version 21. To establish whether the independent variables in the study influenced the dependent variable and consequently answer the research questions, further analyses were done using regression analysis and the Pearson's Product Moment Correlation. Descriptive results were presented in percentage and frequency distribution tables while results of regression and correlation analysis will be presented in correlation matrices.

3.8 Ethical Considerations

Informed consent was obtained from each respondent willing to participate in the study. The researcher introduced himself to the participants and summarily explained the purpose of the study. Respondents were informed of their voluntary participation and that they had a right to anonymity, confidentiality as well as the right to choose not to answer questions if they didn't feel comfortable doing so. They were also informed that they had the right to withdraw from the interview at any time. No direct identifiers were collected from the participants. Confidentiality was ensured since the participants remain anonymous. Identifiers such as name, personal identification numbers, ethnicity and addresses were not collected.

3.9 Operationalization of the Study Variables

Table 3.1: Operationalization of the Study Variables

Research Objectives	Independent Variable	Indicators	Measures	Measurement Scale	Tools of Analysis
To establish influence of availability of infrastructure on ICT integration in curriculum implementation	Availability of ICT infrastructure	• Access to computers • Computer hardware & software, • Telecommunications infrastructure	• Frequency of access • Existing computer hardware and software • Existing telecommunication facilities	Nominal Ordinal	Means Frequency Percentage Regression
To determine the extent to which teachers' use of ICT infrastructure influences ICT integration in curriculum implementation	Teachers' use of ICT infrastructure	• Use of computer hardware and software	• Frequency of access and use of computer • Frequency of use of ICT infrastructure	Nominal	Means Frequency Percentage Pearson's Product Moment Correlation
To determine influence of teachers' level of knowledge of ICT on integration in curriculum implementation	Teachers' level of Knowledge of ICT	• Teachers' computer training background • Teachers' In-service training • Knowledge and skill in usage of ICT	• Kind of training • Extent of knowledge on the usage of computer hardware and software	Ratio Nominal Ordinal	Means Frequency Percentage Pearson's Product Moment Correlation

To establish influence of teachers' attitudes towards ICT on ICT integration in curriculum implementation	Teachers' attitudes towards ICT	• Perceived and problems of ICT use • Willingness to adopt ICT • Confidence in teaching using ICT	• Teachers' perceptions of benefits and problems of ICT use • Willingness & to adopt ICT	Nominal Ordinal	Means Frequency Percentage Pearson's Product Moment Correlation
	Dependent variables ICT integration in Curriculum implementation in Secondary Schools		Number of teachers using ICT in teaching and learning activities	Ratio Nominal	Means Frequency Percentage

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION, INTERPRETATION AND DISCUSSION

4.1 Introduction

The purpose of this study was to examine factors influencing information communication technology integration in curriculum implementation in secondary schools in Gilgil Sub-County, Kenya. This chapter is the presentation, interpretation and discussion of the findings from the data collected from the study respondents as discussed in the preceding chapter. The chapter is divided into: response rate; personal characteristics of the respondents; availability of ICT infrastructure and ICT integration in curriculum implementation, Teachers' Use of ICT Infrastructure and ICT Integration in Curriculum Implementation, teachers' knowledge of ICT and ICT integration in curriculum implementation, teachers' attitudes towards ICT and ICT integration in curriculum implementation and ICT integration in curriculum implementation

4.2 Response Rate

The questionnaire return rate was 82.5%, that is, 189 out of 229 questionnaires that were administered. In addition, a total of 14 in-depth interviews were successfully conducted with school principals out of the targeted sample size of 25 principals, representing a 56% response rate for this category of respondents. Overall, these figures represented a 79.9% response rate for the study. Richardson (2005) citing Babbie (1973) and Kidder (1981) states that 50% is regarded as an acceptable response rate in social research. Campion (1993) suggested that authors need to make reasonable efforts to increase questionnaire return rates so as to ensure that they do not contain any obvious biases. Thus, to ensure adequate response rate, the researcher approached the respondents in person and requested their participation from respondents in, providing information about the purpose of the study, how the results would be used, and clearly explained to them the terms of anonymity and confidentiality. In addition, the respondents were given sufficient time to provide their responses.

4.3 Personal Characteristics of the Respondents

Personal characteristics of respondents play a significant role in social sciences research, since they influence the respondents' expression of their responses about the study problem in terms of their conceptualization and perception of the study problem. In this study, a set of personal characteristics namely, gender, age, level of education/professional qualification and teaching experience among the 189 questionnaire respondents were examined and presented in this section.

4.3.1 Distribution of the Respondents by Gender

Gender is an important variable in any given Kenyan social situation which is variably affected by any social or economic phenomenon. Data related to gender of the questionnaire respondents is presented in Table 4.1.

Table 4.1: Distribution of the Questionnaire Respondents by Gender

Gender of Respondent	Frequency	Percentage
Male	124	65.6
Female	65	34.4
Total	**189**	**100.0**

Out of the total respondents who participated in this study, the majority (65.6%) were male and 34.4% were female. Gender differences and the use of ICT have been reported in several studies. However, studies concerning teachers' gender and ICT use have cited female teachers' low levels of computer use due to their limited technology access, skill, and interest (Volman & Eck, 2001). Research studies revealed that male teachers used more ICT in their teaching and learning processes than their female counterparts (Kay, 2006; Wozney *et al*., 2006).

4.3.2 Distribution of the Questionnaire Respondents by Age Brackets

Age of the respondents is one of the most important characteristics in understanding their views about particular problems; by and large age indicates level of maturity of individuals. Thus, the respondents were asked to indicate their respective age brackets. The findings were as shown in Table 4.2.

Table 4.2: Distribution of the Questionnaire Respondents by Age Brackets

Age Bracket	Frequency	Percentage
23-29 years	86	45.5
30-39 years	74	39.2
40-49 years	10	5.3
50-59 years	19	10.1
Total	**189**	**100.0**

The findings indicate that nearly 46% of the respondents were below 29 years of age, whereas about a tenth (10%) of the respondents were above 50 years of age. More specifically, a large number of the teachers (85%) were below 40 years of age in the sample. Some interesting feature of this data is that the teaching profession, just like in other sectors is dominated by youthful workforce, generally described as the Generation Y or Millennials. This workforce is known to have grown up with frequent IT inventions during prosperous times (Robbins & Judge, 2010) and is generally described as tech-savvy and are at ease with diversity, technology, and online communication. It would therefore be expected that teachers within this age bracket embrace ICT integration in curriculum implementation as they are known to prefer challenging work situations.

4.3.3 Distribution of the Respondents by their Highest Level of Education

Education is one of the most important characteristics that might affect a person's attitudes and the way of looking and understanding any particular social phenomena. In a way, the response of an individual is likely to be determined by their educational status. The respondents were therefore asked to indicate their highest level of education/professional qualification. Their responses were as shown in Table 4.3.

Table 4.3: Distribution of the Respondents by their Highest Level of Education

Level of Education	Frequency	Percentage
Bachelors Degree	131	69.3
Degree with PGDE	31	16.4
Masters Degree	17	9.0
Diploma	10	5.3
Total	**189**	**100.0**

The percentages in Table 4.3 show that 69% of the respondents were Bachelors degree graduates, and a relatively lesser percentage of them, 5% were educated up to the diploma level. The percentage of respondents attaining Masters' degrees was 9%. Cumulatively, about 95% of the respondents had very high professional qualifications. It can be concluded that by and large, a greater majority of the respondents were progressive in education, possessing the higher education that is today critical in creating a knowledge based society. A large body of prior research has shown that highly educated workers tend to adopt new technologies faster than those with less education (Lleras-Muney & Lichtenberg, 2002; Weinberg, 2004). Riddell and Song (2012) report that education increases the probability of using computers on the job. Teachers with higher education possess longer work experiences in using computers than those with lower education levels.

4.3.4 Respondents' Teaching Experience

The respondents' teaching experience at the time of the study was as shown in Table 4.4.

Table 4.4: Respondents' Teaching Experience

Teaching Experience	Frequency	Percentage
Below 5 years	89	47.1
6-10 years	53	28.0
11-15 years	26	13.8
More than 15 years	21	11.1
Total	**189**	**100.0**

The findings indicate that of the 189 teachers who participated in the study through the questionnaire, most of them (47%) had taught for less than 5 years. Only 11% of the respondents had teaching experience of more than 15 years. Cumulatively, about three quarters of the respondents had at most 10 years' teaching experience.

4.4 Availability of ICT infrastructure and ICT integration in curriculum implementation

Integration of ICT in curriculum implementation in a school largely depends on the availability of relevant ICT infrastructure within the school. Thus, the first objective of the study was to establish the extent to which availability of ICT infrastructure influences ICT integration in curriculum implementation in secondary schools in Gilgil Sub-County. The ICT infrastructure considered in this study included presence of computers, computer hardware and software, and telecommunications infrastructure. This section therefore presents the findings on the availability of ICT infrastructure under these sub-sections, then presents and analysis of the relationship between availability of the infrastructure and ICT integration in curriculum implementation.

4.4.1 Availability and Type of Computers in the Schools

The respondents were asked to indicate whether their respective schools had computers and the type and number of each type of the computers. Their responses on the availability of computers were as shown in Table 4.5 below.

Table 4.5: Availability of Computers in the Schools

Does your school have computers?	Frequency	Percentage
Yes	168	88.9
No	21	11.1
Total	**189**	**100.0**

Majority of the respondents (89%) confirmed that their respective schools had computers. Only 11% of the respondents reported lack of computers in their schools. When the sample of schools covered by the study is taken into consideration, the percentage of those who reported lack of computers in their schools translates to at least 2 schools without a computer, a number that was confirmed through direct observation during the survey. The Principals from the two schools also confirmed that their schools did not have computers. The same Principals indicated that most of the services that require use of the computer were said to be outsourced commercially and sometimes from neighbouring schools with computers.

The types of computers available in the schools were mainly desktop computers as confirmed by 88% of the respondents. The percentage of respondents reporting availability of laptop computers alongside the desktops was 16%. Among those who reported availability of computers in their schools, the highest number of desktop computers reported in a school was 100 (3%) while the lowest was one (11%) with a mean of 12 desktop computers per school and a standard deviation of 20.9. The maximum number of laptop computers reported in a single school was 6, with a mean below one. These figures were largely confirmed by the school Principals who blamed lack of adequate financial resources on the failure to provide sufficient computers for teachers' use in curriculum implementation. These findings concur with Karimi's (2012) findings that only 87% of secondary schools in Murang'a District had computers. Although schools have at least a computer, the available computers in the schools are too few compared to facilitate usage by the teachers and students considering the large number of students in the schools. Limited number of computers limits the access to the same by teachers for use in curriculum implementation.

4.4.2 Availability of Computer Hardware

The respondents were asked to indicate the availability and adequacy of various computer related hardware listed in their schools. The findings were as shown in Table 4.6.

Table 4.6: Availability of Computer Hardware

Computer-related hardware		None (%)	Inadequate (%)	Adequate (%)	Total (%)
i.	Projectors	51.3	41.8	6.9	**100**
ii.	DVD	46.6	43.9	9.5	**100**
iii.	VCR	73.5	18.6	7.9	**100**
iv.	Flash discs	37.0	44.5	18.5	**100**
v.	CD ROMS	45.0	37.5	17.5	**100**
vi.	Large screen monitor	73.0	26.5	0.5	**100**
vii.	White boards	50.8	49.2	-	**100**
	Averages	**53.89**	**37.43**	**8.69**	**100**

The findings in Table 4.6 show that all the computer-related hardware were either unavailable or largely inadequate in the schools. For instance, 73% and 74% of the respondents indicated that their respective schools did not have large screen monitors and VCR devices respectively. More than half of the respondents reported that white boards were inadequate, as were 51% of the respondents who gave similar responses in the case of both the and white boards and 47% for the DVD. On average, 8.7% of the respondents reported that the facilities listed were adequate compared to an average of 54% who indicated that their schools had none of the facilities.

The Principals equally alluded to the inadequacy of computer hardware and software, with almost all of them reporting that the available number of hardware devices could not match the huge number of students especially in public schools. In addition, schools did not have up to date software especially those that teachers could easily use to prepare their lessons. They explained that the problem of inadequacy of was so acute ICT infrastructure had serious implications on the teachers' willingness to use the few available infrastructure since the consistency of use may be affected by the need to allow other teachers to use the infrastructure. Such intermittence was said to discourage use of the infrastructure.

Unavailability/inadequacy of the facilitative devices and equipment means that even where computers may be available and adequate in number, their use in the classroom for teaching learning will be limited because output devices such as the projectors and large screen monitors must be connected to the computer to project the learning content. Access to ICT infrastructure and resources in schools is a necessary condition to the integration of ICT in education (Plomp, Anderson, Law, & Quale, 2009). Effective adoption and integration of ICT into teaching in schools depends mainly on the availability and accessibility of ICT resources such as hardware, software, etc. Obviously, if teachers cannot access ICT resources, then they will not use them. Therefore, access to computers, updated software and hardware are key elements to successful adoption and integration of technology.

4.4.3 Availability of Internet Connection in the Schools and Mode of Connectivity

The respondents were required to indicate whether their schools had internet connection or not, and where there was, the mode of connection. Their responses with regard to availability of internet connection were as shown in Table 4.7 below.

Table 4.7: Internet Connection in the Schools

Availability of internet connection	Frequency	Percentage
No	136	72.0
Yes	40	21.1
No response	13	6.9
Total	**189**	**100.0**

Majority of the respondents (72%) reported that they did not have internet connection in their schools. Only 21% indicated that they had internet connections while 7% did not respond to the question. Of those who had access to internet connection, 13.8% did so through prepaid modems while 7.4% accessed the internet through broadband connections. Internet connection was indicated by the school Principals as one of the difficult infrastructure to provide in the schools due to the both installation and operational costs. Such costs were prohibitive to the availability of internet connections in the schools.

4.4.4 Relationship Between Availability of ICT Infrastructure and ICT Integration in Curriculum Implementation

To determine the relationship between availability of ICT infrastructure and ICT integration in curriculum implementation, the Pearson's Product Moment Correlation analysis was adopted. First, an index for availability of ICT infrastructure was constituted. The index comprised the following questionnaire items with the indicated scoring strategy: availability of computers and internet connectivity (Yes=2, No=1), availability/adequacy of computer hardware (None=1, inadequate=2, adequate=3) and number of computers (actual number of each type of computer). The scores on these items were cumulated to get the total scores for availability of ICT infrastructure. With regard to ICT integration in curriculum implementation, the scoring strategy adopted was "Never" =1; "Rarely"=2; "Regularly" =3 4 and "Very regularly"=4. The

individual scores for the eight items in this section were cumulated to obtain a composite score for in ICT integration in curriculum integration for each of the respondents. The total scores for availability of ICT infrastructure and ICT integration were then used to compute the Pearson's Product Moment Correlation (PPMC) coefficient and the findings presented as shown in Table 4.8.

Table 4.8: Relationship Between Availability of ICT Infrastructure and ICT Integration in Curriculum Implementation

		ICT Integration in Curriculum Implementation	Availability of ICT Infrastructure
ICT Integration in Curriculum Implementation	Pearson's (r)	1	.378**
	Sig. (2-tailed)		.000
	N	189	189
Availability of ICT Infrastructure	Pearson's (r)	.378**	1
	Sig. (2-tailed)	.000	
	N	189	189

***. Correlation is significant at the 0.01 level (2-tailed).*

The findings revealed that there was a significant positive relationship between availability of ICT infrastructure and ICT integration in curriculum implementation in secondary schools in Gilgil Sub-County ($r=0.68$, $p<0.05$). Teachers in schools that had more ICT infrastructure were more likely to ingrate ICT in curriculum implementation than those in schools with less ICT infrastructure. These findings were supported by the Principals' assertion that where the ICT infrastructure is adequate, teachers would definitely ensure maximum integration in curriculum implementation in line with the government policy on ICT in education (2006).

4.4.5 Regression Analysis of the Relationship Between Availability Infrastructure and ICT integration in Curriculum Implementation

The relationship between the ICT integration in curriculum implementation and availability of ICT infrastructural facilities was tested by using linear regression analysis. The linear regression equation is given as follows:

$$Y= a+b_1x_1+b_2x_2+b_3x_3+b_4x_4+b_5x_5 + b_6x_6 +b_7x_7+b_8x_8 + b_9x_9 + b_{10}x_{10}$$

Where:

Y= ICT integration in curriculum implementation (Dependent variable)

a = constant

$b_1 – b_{10}$ = regression coefficients

$x_1 - x_{10}$= independent variables (availability of ICT infrastructure) given by:

x_1= availability of computers

x_2= availability of internet connection

x_3 = number of computers (given by the natural logarithm)

x_4 = availability of projectors

x_5 = availability of DVD

x_6 = availability of VCR

x_7 = availability of flash discs

x_8 = availability of CD ROMS

x_9 = availability of large screen monitor

x_{10} = availability of white boards

When ICT integration in curriculum implementation was regressed against availability of the various ICT infrastructural facilities, the ANOVA results shown in Table 4.9 indicated that the regression model was significant ($p<0.05$).

Table 4.9: ANOVA Results for Regression Model

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	1609.414	13	123.801	9.290	.000[b]
Residual	2252.171	169	13.326		
Total	3861.585	182			

a. Dependent Variable: ICT Integration in Curriculum Implementation

b. Predictors: (Constant), White boards , Flash discs, Desktops, Laptops, Large screen monitor, DVD , CD ROMS, VCR, DESKTOPS, Does your school have internet connection?, LAPTOPS, Does your school have computers?, Projectors

The regression model coefficient results for the independent variables (availability of ICT infrastructure) were as shown in Table 4.10.

Table 4.10: Regression Coefficients for Availability of ICT Infrastructure

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	37.306	4.505		8.281	.000
Availability of computers	23.434	4.460	-1.556	-5.254	.000
Availability of internet connection	10.960	1.790	1.269	6.122	.000
Number of computers	6.177	2.369	-.643	-2.607	.010
Availability of Projectors	11.387	2.245	-1.512	-5.072	.000
Availability of DVD	1.758	.703	-.288	-2.499	.013
Availability of VCR	1.829	.973	-.246	-1.879	.062
Availability of Flash discs	1.364	.553	.206	2.467	.015
Availability of CD ROMS	.230	.598	-.038	-.385	.701
Availability of Large screen monitor	3.479	.847	-.361	-4.105	.000
Availability of White boards	16.969	2.638	1.844	6.432	.000

a. Dependent Variable: ICT Integration in Curriculum Implementation

The multivariate correlation and regression analysis revealed that at $p<0.05$, availability of ICT infrastructure namely computers, (both desktop and laptop), internet connection, number of computers, availability of projectors, DVD, flash-disks, large screen monitors and white boards positively affected ICT integration in curriculum implementation. However, the number of desktop computers available, availability of VCR and CD ROMs did not contribute significantly to ICT integration in curriculum implementation. Thus, the resulting regression model would be:

$$Y= 37.31+23.43x_1+10.94x_2+6.18x_3+11.39x_4+1.76x_5 +1.36x_7 +3.48x_9 + 16.97x_{10}.$$

Schools that have adequate ICT infrastructure provide teachers and learners with opportunities to access such facilities, making ICT integration in teaching and learning possible activities and processes possible. The foregoing empirical results are backed up by findings of previous studies including Wastiau *et. al.* (2013) who noted that school insufficient ICT equipment (especially interactive white boards and laptops) were major obstacles to ICT use in Europe and Similarly and Ozden (2007), Afshari (2009) and Mumtaz (2000) who identified lack of computer facilities or insufficient appropriate as obstacles to integration of ICTs. Sustainable integration of ICTs into pedagogical practices needed access to hardware, software and other resources (Mukuna, 2013).

4.5 Teachers' Use of ICT Infrastructure and ICT Integration in Curriculum Implementation

The second objective of the study was to determine the extent to which teachers' use of ICT infrastructure influences ICT integration in curriculum implementation in secondary schools in Gilgil Sub-County. This section therefore is a presentation of teachers' use of ICT infrastructure and the relationship between the use and integration of ICT in curriculum implementation.

4.5.1 Teachers' Use of ICT Infrastructure

The respondents were asked to indicate how often they used ICT facilities in teaching listed within their schools. Their responses based on the use of both computer hardware and software were analyzed descriptively and the findings were as presented in Table 4.11 below.

Table 4.11: Teachers' Use of ICT Infrastructure

ICT Facilities	Never (%)	Rarely (%)	Often (%)	Daily (%)	Total (%)
Computer Hardware					
i. Projector	47.1	32.8	19.6	0.5	**100**
ii. DVD	36.5	28.0	25.4	10.1	**100**
iii. VCR	56.6	36.5	0.5	6.3	**100**
iv. Flash discs	53.4	29.6	10.4	6.5	**100**
v. CD-ROM	36.0	28.6	21.7	13.8	**100**
vi. White boards	74.1	16.9	9.0	-	**100**
vii. Large screen monitor	48.1	23.3	15.3	13.2	**100**
Averages	**42.63**	**23.73**	**14.56**	**7.20**	**100**
Computer Software					
i. E-mail	30.2	24.9	18.5	26.5	**100**
ii. Internet	29.1	19.0	14.8	37.0	**100**
iii. Word processing	27.0	14.8	35.4	22.8	**100**
iv. Spreadsheet (e.g. Excel)	29.6	27.5	16.4	26.5	**100**
v. Databases (e.g. Ms-access)	30.7	30.7	25.9	12.7	**100**
vi. Printing or drawing	22.8	27.5	19.6	30.2	**100**
vii. Games or simulations	47.6	22.2	13.2	16.9	**100**
viii. Power point	41.3	32.3	11.1	15.3	**100**
Averages	**32.74**	**25.70**	**20.01**	**21.56**	**100**

The findings in Table 4.11 reveal that on average, teachers used computer software more often than they used the hardware that is necessary to facilitate ICT integration in curriculum implementation. For instance, an average of 21.6% of the teachers indicated that they used computers software on a daily basis compared to 7.2% average usage of the computer hardware. This trend was also replicated in the 20% average usage of computer software compared to 14.6% usage of computer hardware often. The computer hardware that was never used on a daily basis was the white board as none of the respondents indicated so, which could be attributed to the earlier finding that none of the respondents reported their schools as having adequate white boards. The Principals reported that a vast majority of teachers rarely used the computer hardware regularly, but where internet was available, teachers would mostly used the ICT facilities to access the internet. However, the Principals decried such use accusing teachers of mainly using the internet for to search for information related to their personal benefits such as research work and reading email rather than sourcing for information related to curriculum and instruction.

When teachers' use of ICT hardware facilities was compared to their availability, whereas the average adequacy of the facilities was found to be 8.7, average daily usage of the ICT facilities by the teachers was 1.5% less (7.2%) implying that even where ICT infrastructure was available and adequate, not all teachers optimally utilized the facilities in teaching and learning activities.

4.5.2 Comparison of Availability of ICT Infrastructure and Teachers' Use of the Infrastructure

Teachers' use of ICT Infrastructure (Computer hardware only) was scored on a 4-point scale, where 1 = Never; 2 = Rarely; 3 = Often and 4 = Daily. The scores for use of the computer hardware were cumulated for each respondent and their means computed. The means were then compared with the means of availability of ICT infrastructure using the one samples t-test to determine whether there were any significant differences between availability of ICT infrastructure and teachers' use of the infrastructure. The findings were as shown in Table 4.12.

Table 4.12: One Samples t-test for the Comparison of Availability of ICT Infrastructure and Teachers' Use of the Infrastructure

	Test Value = 0					
	T	Df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Availability of ICT Infrastructure	47.488	188	.000	1.55858	1.4938	1.6233
Teachers' Use of ICT Infrastructure	46.317	188	.000	1.37778	1.2043	1.5513

The results in Table 4.12 revealed that the mean of availability of ICT infrastructure was 1.56 and that of teachers' use of ICT infrastructure was 1.38, with a mean difference of 0.18. There were statistically differences in the means of availability of ICT infrastructure (t-value=47.49; df = 188; P<0.05) and teachers' use of ICT infrastructure (t-value=46.32; df = 188; P<0.05). These findings indicate that teachers were not optimally using ICT infrastructure that were available in the schools.

4.5.3 Relationship Between Teachers' Use of ICT Infrastructure and ICT Integration in Curriculum Implementation

The means for teachers' use of ICT infrastructure (both hardware and software) and the means for ICT integration in curriculum implementation were used to compute the Pearson's Product Moment Correlation to determine whether there was a relationship between the two variables. The findings were as shown in Table 4.13.

Table 4.13: Relationship Between Teachers' Use of ICT Infrastructure and ICT Integration in Curriculum Implementation

		ICT Integration in Curriculum Implementation	Teachers' Use of ICT Hardware Infrastructure	Teachers' Use of ICT Software Infrastructure
ICT Integration in Curriculum Implementation	Pearson's (r)	1	.682**	.661**
	Sig. (2-tailed)		.000	.000
	N	189	189	189
Teachers' Use of ICT Hardware Infrastructure	Pearson's (r)	.682**	1	.830**
	Sig. (2-tailed)	.000		.000
	N	189	189	189
Teachers' Use of ICT Software Infrastructure	Pearson's (r)	.661**	.830**	1
	Sig. (2-tailed)	.000	.000	
	N	189	189	189

***. Correlation is significant at the 0.01 level (2-tailed).*

The results in Table 4.13 show that there was a significant positive relationship between teachers' use of ICT hardware infrastructure and ICT integration in curriculum implementation ($r=0.68$; $p<0.05$) and teachers' use of ICT software infrastructure and ICT integration in curriculum implementation ($r=0.66$; $p<0.05$). The correlations were relatively strong, indicating that ICT integration in curriculum implementation was strongly associated with teachers' frequent use of ICT hardware and software infrastructure. The strong, positive correlation between teachers' use of ICT hardware and software infrastructure ($r=0.83$; $p<0.05$) shows that teachers who used ICT hardware were also most likely to use ICT software infrastructures, which are requisite to ICT integration in curriculum implementation.

4.6 Teachers' Level of Knowledge of ICT and ICT Integration in Curriculum Implementation

The fourth objective of the study was to establish the extent to which teachers' level of knowledge of ICT influences ICT integration in curriculum implementation in secondary schools in Gilgil Sub-County. Thus, this section is a description of teachers' level of ICT training, knowledge of ICT and the relationship between teachers' knowledge of ICT and ICT integration in curriculum implementation.

4.6.1 Teachers' Level of ICT Training

The respondents were asked to indicate their level of ICT acquired as at the time of the study. Their responses were as shown in Table 4.14.

Table 4.14: Teachers' Level of ICT Training

Level of ICT Training	Frequency	Percentage
Certificate Proficiency packages	96	50.8
Diploma in ICT	41	21.7
Inset ICT training	41	21.7
Course unit during training as a teacher	11	5.8
Total	**189**	**100.0**

Slightly more than half of the respondents had acquired certificate of proficiency in computer packages. Equal percentage of the respondents (22%) had acquired either a

diploma in ICT or inset ICT training while at most 6% had acquired ICT training as a course unit during initial training in education. The school Principals lamented that their teachers lacked the requisite confidence to integrate ICT in curriculum implementation due to the fact that they had not received adequate ICT training.

4.6.2 Teachers' Knowledge of ICT

The respondents were asked to describe their level of knowledge of usage of ICT facilities and computer software listed on a given rating scale ranging from 1-5, where 1= None, 2 = Some, 3 = Low, 4 = Average and 5 = High. The means of the respondents' knowledge scores were computed and the findings were as presented in Table 4.15.

Table 4.15: Teachers' Knowledge of ICT

ICT Infrastructure		N	Minimum	Maximum	Mean	Std. Dev.
i.	Internet	189	1	5	3.79	1.486
ii.	Microsoft Word processing	189	1	5	3.79	1.472
iii.	E-mail (sending and receiving messages)	189	1	5	3.74	1.572
iv.	Printing or drawing	189	1	5	3.69	1.384
v.	Spreadsheet (e.g. Excel)	189	1	5	3.59	1.550
vi.	Games or simulations	189	1	5	3.52	1.339
vii.	Power point	189	1	5	3.43	1.423
viii.	DVD	189	1	5	3.42	1.433
ix.	CD-ROM	189	1	5	3.37	1.455
x.	Projector	189	1	5	3.10	1.407
xi.	Databases (e.g. Ms-access)	189	1	5	2.90	1.468
xii.	VCR	189	1	5	2.63	1.491
xiii.	Large screen monitor	189	1	5	2.51	1.390

The means ranged from 3.79 (highest) to 2.51 (lowest). The highest mean was related to teachers' knowledge of internet as well as Microsoft Word processing with standard deviations of 1.49 and 1.47 respectively while the lowest mean was related to teachers' knowledge of large screen monitor with a standard deviation of 1.39. On average, when

the mean scores are compared to the rating scale of 1-5, the findings imply that teachers' knowledge of ICT in ICT ranged from low to average, with the findings indicating that teachers were more knowledgeable in the computer software than hardware. In fact, teachers had low knowledge levels in all the computer hardware. It can therefore be concluded that teachers were just about functionally knowledgeable in ICT, which provides a basis for further ICT training to strengthen teachers' knowledge of ICT that is critical for ICT integration in curriculum implementation.

4.6.3 Relationship between Teachers' Knowledge of ICT and ICT Integration in Curriculum Implementation

The respondents' total scores on knowledge of ICT were cumulated and their means computed for each respondent. The Pearson's Product Moment Correlation analysis was then conducted using means of their knowledge as the independent variable and ICT integration in curriculum implementation as the dependent variable. The results of the correlation analysis were as shown in Table 4.16.

Table 4.16: Relationship between Teachers' Knowledge of ICT and ICT Integration in Curriculum Implementation

		Teachers' Knowledge of ICT	ICT Integration in Curriculum Implementation
Teachers' Knowledge of ICT	Pearson Correlation	1	.493**
	Sig. (2-tailed)		.000
	N	189	189
ICT Integration in Curriculum Implementation	Pearson Correlation	.493**	1
	Sig. (2-tailed)	.000	
	N	189	189

***. Correlation is significant at the 0.01 level (2-tailed).*

The results in the table above revealed that there was a significant positive relationship between teachers' knowledge of ICT and ICT integration in curriculum implementation ($r=0.49$; $p<0.05$). The correlation was of moderate strength, indicating that ICT integration in curriculum implementation was associated with teachers' knowledge of ICT. The higher the teachers' knowledge in ICT the more likely they are to integrate

ICT in curriculum implementation. Pelgrum *et al.* (2003) found that teachers' lack of knowledge and skills was the second most inhibiting obstacle to the use of computers in schools. Similarly, in the United States, Knezek and Christensen (2002) hypothesized that high levels of skill and knowledge (proficiency) would produce higher levels of technology integration that will reflect on student achievements positively. Evidence suggests that majority of teachers who reported negative or neutral attitude towards the integration of ICT into teaching and learning processes lacked knowledge and skills that would allow them to make "informed decision" (Bordbar, 2010).

4.7 Teachers' Attitudes Towards ICT and ICT Integration In Curriculum Implementation

The fourth and final objective of the study was to determine the extent to which teachers' attitudes towards ICT influences ICT integration in curriculum implementation. This section is therefore describes teachers' attitudes towards ICT, which is then correlated with ICT integration in curriculum implementation.

4.7.1 Teachers' Attitudes Towards ICT

The respondents were provided with a set of eight (8) statements for which they were asked to circle the description that closely matched their individual experiences by indicating their level of agreement with the statements, from strongly disagree to strongly agree. There were 4 positive attitude and 4 negative attitude statements.

The findings in Table 4.17 show that among the positive statements, the highest percentages responded positively by strongly agreeing with the statements. For instance, 70% of the respondents indicated their strong agreement with the statement that use of the computer would allow them to develop their teaching while 58% strongly agreed that the school as a whole benefits from the introduction of ICT. On average, 56.4% of the respondents indicated their strong agreement with the four positive statements compared to 2.9% who strongly disagreed. However, a significant 28.3% "disagreed" with the state the positive ICT attributes.

4.17: Teachers' Attitudes Towards ICT (%)

		Strongly disagree	Disagree	Unable to respond	Agree	Strongly agree	Total
Positive Attitude							
i.	The use of the computer will allow me to develop my teaching	2.1	14.3	5.3	7.9	70.4	**100**
ii.	ICT enables teachers to help curriculum areas outside their own	4.2	39.2	6.9	3.7	46.0	**100**
iii.	The school as a whole benefits from the introduction of ICT	3.2	30.7	-	8.5	57.7	**100**
iv.	Integration of ICT in curriculum implementation is effective in developing learners' knowledge and skills	2.1	29.1	3.7	13.8	51.3	**100**
	Averages	**2.90**	**28.33**	**3.98**	**8.48**	**56.35**	**100**
	Negative statements						
i.	The impact of ICT integration on students' learning is negligible	28.6	12.7	5.8	26.5	26.5	**100**
ii.	Getting to know integration of ICT in curriculum implementation takes up too much of teacher's time	25.4	18.0	.5	46.6	9.5	**100**
iii.	ICT integration imposes excessive demands on teachers	39.2	27.5	3.7	25.4	4.2	**100**
iv.	The use of ICT interferes with other aspects of my work	45.5	-	3.7	42.9	7.9	**100**
	Averages	**34.68**	**14.55**	**3.43**	**35.35**	**12.03**	**100**

For each of the negative statements, respondents' responses were randomly distributed with the highest percentages occurring evenly. For instance, the highest percentage of the respondents (47%) "Agreed" that getting to know integration of ICT in curriculum implementation takes up too much of teacher's time; 46% and 39% "Strongly disagreed" that use of ICT interferes with other aspects of their work and that ICT integration imposes excessive demands on teachers respectively. On the other hand, a

significant 43% “Agreed” that use of ICT interferes with other aspects of their work. On average, the highest percentages of the respondents at about 35% either “Agreed” or “Disagreed” with the negative attitude statements.

4.7.2 Means of Teachers’ Attitudinal Responses Towards ICT

The means of teachers’ responses to the attitudinal statements were computed by adopting a scoring strategy where, for the positive statements, a scale of 1-5 (strongly disagree to strongly agree) was adopted and for the negative statements, the scale was reversed to 5-1 (strongly disagree to strongly agree). The means and standard deviations of the scores were as presented in Table 4.18.

Table 4.18: Means of Teachers’ Attitudinal Responses Towards ICT

Statement		N	Min	Max	Mean	Std. Dev
i.	Use of the computer will allow me to develop my teaching	189	1	5	4.30	1.198
ii.	The school as a whole benefits from the introduction of ICT	189	1	5	3.87	1.443
iii.	Integration of ICT in curriculum implementation is effective in developing learners’ knowledge and skills	189	1	5	3.83	1.373
iv.	ICT integration imposes excessive demands on teachers	189	1	5	3.72	1.325
v.	ICT enables teachers to help curriculum areas	189	1	5	3.48	1.490
vi.	The use of ICT interferes with other aspects of my work	189	1	5	3.32	1.573
vii.	Getting to know integration of ICT in curriculum implementation takes up too much of teacher’s time	189	1	5	3.03	1.433
viii.	Impact of ICT integration on students’ learning is negligible	189	1	5	2.90	1.612

The findings in Table 4.18 show that the means ranged from 4.3 (highest) to 2.9 (lowest). The highest mean was related to “Use of the computer will allow me to develop my teaching” while the lowest mean was associated with “Impact of ICT integration on students’ learning is negligible”. From the findings, it can be observed that the positive attitudinal statements had relatively higher means compared to the negative attitudinal statements. It can therefore be concluded that teachers had relatively positive attitudes towards ICT. These positive attitudes are important to ICT integration because as Divaharan and Ping (2010) and Özden (2007) suggest, effective

use of computers is dependent on the teachers' intentions, personal beliefs and attitudes towards teaching with technology and ICT use because such beliefs and attitudes influence what they do in classrooms. Prior studies have reported that teachers' actual ICT use was related to their perceptions (Altun, Alev & Yigit, 2009; Keengwe & Onchwari, 2008; Lau & Sim, 2008). Eugene (2006) explored the effect of teachers' beliefs and attitudes towards the use of ICT in classrooms. The study revealed that there was inconsistency between teachers' beliefs and their actual use of technology in classroom. Teachers' beliefs and teaching practices were found not to match. The inconsistency between teachers' actual use of ICT and perception were attributed to inadequate supply of ICT resources, lack of access to the right kinds of technology, inadequate ICT pedagogical training and insufficient administrative support.

4.7.3 Relationship Between Teachers' Attitudes Towards ICT and ICT Integration in Curriculum Implementation

The means of teachers' attitudes towards ICT were used to compute the Pearson's Product Moment Correlation against ICT integration in curriculum implementation to determine whether there was a relationship between teachers' attitudes towards ICT and ICT integration in curriculum implementation. The results were as shown in Table 4.19.

Table 4.19: Relationship Between Teachers' Attitudes Towards ICT and ICT Integration In Curriculum Implementation

		ICT Integration in Curriculum Implementation	Teachers' Attitudes towards ICT
ICT Integration in Curriculum Implementation	Pearson Correlation	1	.179*
	Sig. (2-tailed)		.014
	N	189	189
Teachers' Attitudes towards ICT	Pearson Correlation	.179*	1
	Sig. (2-tailed)	.014	
	N	189	189

**. Correlation is significant at the 0.05 level (2-tailed).*

The correlation analysis revealed that there was a significant, positive correlation between teachers' attitudes towards ICT and ICT integration in curriculum implementation ($r=0.18$; $p<0.05$). The correlation was weak in strength, indicating that ICT integration in curriculum implementation was weakly associated with teachers' positive attitudes towards ICT. These findings were in agreement with the findings of previous studies such as Sang *et al*. (2009); Zhao & Cziko (2001); Kumar *et al.* (2008) that reported that teachers' attitude and motivation influence their adoption of ICT. Similarly, Teo (2008) conducted a survey on pre-service teachers' attitudes towards computer use in Singapore and found that teachers were more positive about their attitude towards computers and intention to use computer than their perceptions of the usefulness of the computer and their control of the computer. Demirci (2009) conducted a study on teachers' attitudes towards the use of Geographic Information systems (GIS) in Turkey and revealed that though barriers such as lack of hardware and software existed, teachers' positive attitudes towards GIS was an important determinant to the successful integration of GIS into geography lessons.

It can be concluded from the foregoing that to successfully initiate and implement educational technology in the school program depends strongly on the teachers' support and attitudes. Tella, (2007) found that computer use was predicted by intentions to use and that perceived usefulness was also strongly linked to these intentions. More evidence suggests that teachers' attitudes and beliefs influence successful integration of ICT into teaching (Hew & Brush, 2007; Keengwe & Onchwari, 2008). If teachers' attitudes are positive toward the use of educational technology then they can easily provide useful insight about the adoption and integration of ICT into teaching and learning processes. It is believed that if teachers perceived technology programs as neither fulfilling their needs nor their students' needs, it is likely that they will not integrate the technology into their teaching and learning.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The purpose of this study was to examine factors influencing information communication technology integration in curriculum implementation in secondary schools in Gilgil Sub-County, Kenya. This chapter therefore presents a summary of findings, conclusions and recommendations. The chapter further summarizes the contribution of the study to the existing body of knowledge and finally gives suggestions for further research.

5.2 Summary of the findings

The study utilized responses from 203 respondents, representing an overall 79.9% response rate. Majority of the questionnaire respondents (65.6%) were male and 34.4% were female. Cumulatively, 85% of the teachers were below 40 years of age. Majority (69%) of the respondents were Bachelors degree graduates, and a relatively lesser percentage of them, 5% were educated up to the diploma level. The percentage of respondents attaining Masters' degrees was 9%. About three quarters of the respondents had at most 10 years' teaching experience.

With regard to availability of ICT infrastructure in the schools, the study established that most of the schools had computers. Only 11% of the respondents reported lack of computers in their schools (Table 4.5). The types of computers available in the schools were mainly desktop computers as confirmed by 88% of the respondents. All the computer-related hardware was either unavailable or largely inadequate in the schools as shown in Table 4.6. It was further established that there was a significant positive relationship between availability of ICT infrastructure and ICT integration in curriculum implementation in secondary schools in Gilgil Sub-County ($r=0.68$, $p<0.05$) (Table 4.8).

On teachers' Use of ICT Infrastructure and ICT Integration in curriculum implementation, it was established that on average, teachers used computer software more often than they used the hardware as can be inferred from Table 4.11. For

instance, an average of 21.6% of the teachers indicated that they used computer software on a daily basis compared to 7.2% average usage of the computer hardware. There were statistically differences in the means of availability of ICT infrastructure (t-value=47.49; df = 188; P<0.05) and teachers' use of ICT infrastructure (t-value=46.32; df = 188; P<0.05) as shown in Table 4.12. On the other hand, there was a significant positive relationship between teachers' use of ICT hardware infrastructure and ICT integration in curriculum implementation (r=0.68; p<0.05) and teachers' use of ICT software infrastructure and ICT integration in curriculum implementation (r=0.66; p<0.05) as shown in Table 4.13.

Results of teachers' level of knowledge of ICT showed that slightly more than half of the respondents had acquired certificate of proficiency in computer packages. Equal percentages of the respondents (22%) had acquired either a diploma in ICT or inset ICT training while at most 6% had acquired ICT training as a course unit during initial training in education (Table 4.14). With respect to knowledge of ICT hardware and software, the mean knowledge levels ranged from 3.79 (highest) to 2.51 (lowest). On average, teachers' level of knowledge of ICT ranged from low to average, with the findings indicating that teachers were more knowledgeable in the computer software than hardware as can be seen in Table 4.15. There was a significant positive relationship between teachers' knowledge of ICT and ICT integration in curriculum implementation (r=0.49; p<0.05) (Table 4.16).

Finally, on the influence of teachers' attitudes towards ICT and ICT integration in curriculum implementation, the study established that the means attitudinal levels ranged from 4.3 (highest) to 2.9 (lowest) as shown in Table 4.18. The highest mean was related to "Use of the computer will allow me to develop my teaching" while the lowest mean was associated with "Impact of ICT integration on students' learning is negligible". Positive attitudinal statements had relatively higher means compared to the negative attitudinal statements. The correlation analysis revealed that there was a significant, positive correlation between teachers' attitudes towards ICT and ICT integration in curriculum implementation (r=0.18; p<0.05) as shown in Table 4.19.

5.3 Conclusions

The findings of this study show that availability and accessibility of ICT infrastructure in the secondary schools in Gilgil Sub-County is still far from being achieved. Although almost all the schools had at least a computer, the computers were too few to optimally support ICT integration in curriculum implementation. In addition, there were general inadequacies of computer-related hardware and peripheral devices used together with the computers to support ICT teaching and learning environments. Nevertheless, schools that have adequate ICT infrastructure have successfully integrated ICT in curriculum implementation although at sub-optimal levels.

Teachers use computer software more often than they use the hardware, which may be explained by inadequacy of the ICT facilities in schools and teachers' access to computers and related software outside the school environments. On the other hand, availability of ICT infrastructure is not synonymous to their use by the teachers. Statistically significant differences were noted between availability of ICT infrastructure and teachers' use of the infrastructure, indicating that available ICT facilities are not optimally used in curriculum implementation. However, where teachers have made use of the ICT infrastructure, significant strides have been made towards ICT integration in curriculum implementation as evidenced by the positive correlation between teachers' use of ICT hardware and software infrastructure and ICT integration in curriculum implementation.

The study results show that teachers' level of knowledge of ICT is a key factor in the successful integration of ICT in curriculum implementation. Unfortunately, teachers' competence in ICT is limited by low ICT-related professional development given that most teachers possess only functional ICT knowledge and skills. Higher ICT knowledge levels have potential to positively influence ICT integration in curriculum implementation as exhibited by the positive correlation between teachers' knowledge of ICT and ICT integration in curriculum implementation.

Teachers' attitude towards ICT is a correlate of ICT integration in curriculum implementation. However, teachers' attitude is linked to their confidence in using ICT to teach, which is influenced by accessibility to ICT resources and teacher competence. Availability of ICT resources, perceived ability to use ICT and having basic skills to

operate it may increase teachers satisfaction with modern technologies which may in turn motivate teachers to integrate ICT in teaching.

5.4 Recommendations

This study has highlighted the height of ICT infrastructural inadequacies in secondary schools in Gilgil Sub-County, which most likely affects secondary schools in other parts of Kenya. There is therefore need for all the stakeholders in the education sector to join hands in supporting the schools to acquire the requisite ICT infrastructure if the ICT in education Policy (2006) is to be effectively implemented in schools.

The study has also shown that although teachers may have access to ICT resources, they cannot use ICT in the classroom because it may be difficult for them to operate ICT tools due to their incapacity to effectively use the tools. Thus, teachers should be provided with technical assistance because this assistance may provide them with up-to date equipment in the new world of technology. This would allow teachers access to and utilization of ICT resources and thus help in the successful integration of technology in teaching processes.

It is further recommended that teachers be given sufficient training on ICT use and integration into teaching and learning processes. This will help teachers to acquire the requisite knowledge and skills in integrating ICT technology in curriculum implementation, which will in turn provide opportunities for teachers to support student-centered learning. According to Russell, Bebell, O'Dwyer and O'Connor (2003), teachers should be trained on specific instructional use of technology instead of general use of computers.

Finally, based on the results of the study in relation to teachers' attitudes towards ICT, it is recommended that teachers understanding of the relevance and importance of integrating ICT in curriculum implementation be enhanced through support by the school administration as well as other education stakeholders. This will inculcate positive teacher attitudes towards ICT which is requisite to their use of ICT in teaching and learning.

5.5 Suggestions for Further Studies

The following are suggestions for some of the areas where further research may be done:

1. Similar studies to be carried out in other Sub-Counties so as to enable generalization of the findings to a wider scope

2. This study acknowledges that many factors exist in literature that potentially affects the integration of ICT in curriculum implementation. Since this study was limited to only four factors, other studies in the same area could explore those factors that were not covered by this study broadly, which could broadly be categorized into school-related, teacher-related, student-related factors and curriculum-related factors.

5.6 Contribution to Body of Knowledge

Table 5.1 shows the contribution of the study to the body of Knowledge

Table 5.1:

Contribution to Body of Knowledge

	Objective	Contribution to Body of Knowledge
1.	To establish the extent to which availability of ICT infrastructure influences ICT integration in curriculum implementation.	Availability and accessibility of ICT infrastructure in the secondary schools in Gilgil Sub-County is still far from being achieved. Although almost all the schools had at least a computer, the computers were too few to optimally support ICT integration in curriculum implementation. In addition, there were general inadequacies of computer-related hardware and peripheral devices used together with the computers to support ICT teaching and learning environments. Nevertheless, schools that have adequate ICT infrastructure have successfully integrated ICT in curriculum implementation although at sub-optimal levels.
2.	To determine the extent to which teachers' use of ICT infrastructure influences ICT integration in curriculum implementation	Teachers use computer software more often than they use the hardware. On the other hand, availability of ICT infrastructure is not synonymous to their use by the teachers. Statistically significant differences were noted between availability of ICT infrastructure and teachers' use of the infrastructure, indicating that available ICT facilities are not optimally used in curriculum implementation. However, where teachers have made use of the ICT infrastructure, significant strides have been made towards ICT integration in curriculum implementation as evidenced by the positive correlation between teachers' use of ICT hardware and software infrastructure and ICT integration in curriculum implementation.
3.	To establish the extent to which teachers' knowledge of ICT influences ICT integration in curriculum implementation	Teachers' knowledge of ICT is a key factor in the successful integration of ICT in curriculum implementation. Unfortunately, teachers' competence in ICT is limited by low ICT-related professional development given that most teachers possess only functional ICT knowledge and skills. Higher ICT knowledge levels have potential to positively influence ICT integration in curriculum implementation as exhibited by the positive correlation between teachers' knowledge of ICT and ICT integration in curriculum implementation.
4.	To determine the extent to which teachers' attitudes towards ICT influences ICT integration in curriculum implementation	Teachers' attitude towards ICT is a correlate of ICT integration in curriculum implementation. However, teachers' attitude is linked to their confidence in using ICT to teach, which is influenced by accessibility to ICT resources and teacher competence. Availability of ICT resources, perceived ability to use ICT and having basic skills to operate it may increase teachers satisfaction with modern technologies which may in turn motivate teachers to integrate ICT in teaching.

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APPENDICES

Appendix I: Introduction Letter

Agatha Wanga

P.O Box

Mombasa.

To Whom It May Concern

Re: Research Study

This questionnaire seeks to collect data that will be used to establish the factors influencing the integration of ICT in curriculum implementation in secondary schools in Gilgil Sub-County, Kenya. You/your school has been selected by chance from all the secondary schools in the County to assist in providing the required information, since your views are considered important to this study.

I therefore kindly request you to answer the questions in the attached questionnaire as honestly as possible as per the guidelines indicated. I further assure you that your answers to this questionnaire will be used for purposes of research only and your identity will not be disclosed to anyone whatsoever.

Thank you.

Yours faithfully,

Agatha Wanga

Appendix II: Teachers' Questionnaire

Introduction and Consent

The purpose of this questionnaire is to collect data relating to the factors that influence ICT integration in curriculum implementation in secondary schools in Gilgil Sub-County. Your school and you in particular, as a teacher involved in curriculum implementation, have been identified by chance from among the other schools/teachers in the Sub-County to participate in the study. Thus, you are hereby requested to complete this questionnaire. Note that any information given with respect to this request shall be treated with strict confidentiality and will only be used for the purpose of this research only.

Kindly indicate your consent to participate in the study prior to completion of the questionnaire:

☐ **I agree** ☐ **I disagree**

SECTION 1: DEMOGRAPHIC CHARACTERISTICS

1. Kindly indicate your gender
   ☐ Male ☐ Female
2. In which age bracket do you fall?
   ☐ 23-29 years ☐ 40-49 years
   ☐ 30-39 years ☐ 50-59 years
3. Highest Level of Education/Professional qualification
   ☐ Masters ☐ Degree with PGDE
   ☐ Degree ☐ Diploma
4. Teaching experience
   ☐ Below 5 years
   ☐ 6-10 years
   ☐ 11-15 years
   ☐ More than 15 years

SECTION 2: AVAILABILITY OF ICT INFRASTRUCTURE

1. Does your school have computers?

   ☐ Yes

   ☐ No

2. If yes, what types of computers are available?

   ☐ Desktop Computers

   ☐ Laptops

3. How many of each of the computer types you have indicated above are available?

   _____

5. Does your school have internet connection?

   ☐ Yes

   ☐ No

6. If yes in 11 above, what kind of connection exists?

   ☐ Pre-paid modem

   ☐ Broadband internet server

Apart from the computers, which of the following facilities does your school have and how adequate are they for use for teaching and learning?

Facility	**None**	**Inadequate**	**Adequate**
1. Projectors			
2. DVD			
3. VCR			
4. Flash discs			
5. CD ROMS			
6. Large screen monitor			
7. White boards			

SECTION 3: TEACHERS' USE OF ICT INFRASTRUCTURE

Please rate how often teachers use the following ICT facilities in teaching using the given scale, where 1 = **Never**; 2 = **Rarely**; 3 = **Regularly**; 4 = **Very regularly**

ICT Facilities	**1**	**2**	**3**	**4**
1. CD-ROM				
2. VCR				
3. Projector				
4. Internet				
5. Electronic learning				
6. E-mail (sending and receiving messages)				
7. Large screen monitor				
8. Word processing				
9. Spreadsheet (e.g. Excel)				
10. Databases (e.g. Ms-access)				
11. Printing or drawing				
12. Games or simulations				
13. Power point				

SECTION 4: TEACHERS' KNOWLEDGE OF ICT

1. What is the level of ICT training acquired to date?

☐ Certificate Proficiency packages

☐ Diploma in ICT

☐ Course Unit during training

☐ Inset ICT training

Please describe your level of knowledge of usage of the facilities and computer software listed here using the rating scale described below

1 – None **4 – Average**
2 – Some **5 - High**
3 – Low

Facility	**1**	**2**	**3**	**4**	**5**
1. CD-ROM					
2. VCR					
3. Projector					
4. Internet					
5. DVD					
6. E-mail (sending and receiving messages)					
7. Large screen monitor					
8. Word processing					
9. Spreadsheet (e.g. Excel)					
10. Databases (e.g. Ms-access)					
11. Printing or drawing					
12. Games or simulations					
13. Power point					

SECTION 5: TEACHERS ATTITUDE TOWARDS ICT

This section invites you to offer your views on a range of issues concerning IT. Circle the description that closely matches your experience

1- **Strongly agree**
2- **Agree**
3- **Unable to respond**
4- **Disagree**
5- **Strongly disagree**

Issue	**Response**				
1. The use of the computer will allow me to develop my teaching	**1**	**2**	**3**	**4**	**5**
2. The impact of ICT integration on students' learning is negligible	**1**	**2**	**3**	**4**	**5**
3. Getting to know integration of ICT in curriculum implementation takes up too much of teacher's time	**1**	**2**	**3**	**4**	**5**
4. ICT integration imposes excessive demands on teachers	**1**	**2**	**3**	**4**	**5**
5. The use of ICT interferes with other aspects of my work	**1**	**2**	**3**	**4**	**5**
6. ICT enables teachers to help curriculum areas outside their own	**1**	**2**	**3**	**4**	**5**
7. The school as a whole benefits from the introduction of ICT	**1**	**2**	**3**	**4**	**5**
8. Integration of ICT in curriculum implementation is effective in developing learners' knowledge and skills	**1**	**2**	**3**	**4**	**5**

SECTION 6: INTEGRATION OF ICT IN CURRICULUM IMPLEMENTATION

On a scale of 1- 4 (where 1 = **Never**; 2 = **Rarely**; 3 = **Regularly**; 4 = **Very regularly**) Please rate how often teachers in your school use the ICT facilities/infrastructure available in the school for the following purpose.

Purpose	**1**	**2**	**3**	**4**
1. Preparation of lesson presentations				
2. Presentation of the lesson				
3. Preparation of assignments and tests				
4. Preparation of students' results				
5. Research on curriculum content				
6. Students' Encyclopedia				
7. Practical demonstrations				
8. Simulation of key subject concepts				

Thank you for taking time to respond to the questions

Appendix III: School Principals' Interview Guide

Introduction
Good morning/Afternoon

My name is **Agatha Wanga**, a student at the University of Nairobi currently undertaking a Masters Degree in Project Planning and Management. I am in the process of collecting data for my research project whose purpose is to establish factors that influence ICT integration in curriculum implementation in secondary schools in Gilgil Sub-County. Your school and you in particular, as the Principal have been identified by chance from among the other schools/Principal in the Sub-County to participate in the study. Therefore, I would like to take about 45 minutes of your time to ask you a few questions related to ICT integration in curriculum implementation in your school. Note that any information you give with respect to this request shall be treated with strict confidentiality and will only be used for the purpose of this research only. Do you have any question or any need any clarification? If you will allow me, I would like to as you the following questions:

1. Does your school have computers? If yes, what types of computers are available and how many in each case?
2. What other computer appliances/infrastructure are available in your school?
3. Is the available ICT infrastructure adequate for ICT integration in curriculum implementation in your school? Please explain your answer.
4. Do teachers in your school use the available ICT infrastructure? If yes, how often do they use the infrastructure and for what purposes?
5. Briefly describe how teachers' use of the ICT infrastructure influences ICT integration in curriculum implementation in your school
6. How would you describe the level of ICT knowledge among you teaching staff? How does this knowledge affect ICT integration in curriculum implementation in the school?
7. Briefly describe the attitude of your teaching staff towards ICT. Would you say teachers' attitude affect ICT integration in curriculum implementation in your school? How?

That is all I had to ask you. Thank you for taking your time to respond to my questions

Appendix IV: Krejcie and Morgan's (1970) Table for Determining Sample Size from a Given Population

N ----- S	N ----- S	N ----- S	N ----- S	N ----- S
10-----10	100-----80	280-----162	800-----260	2800-----338
15-----14	110-----86	290-----165	850-----265	3000-----341
20-----19	120-----92	300-----169	900-----269	3500-----346
25-----24	130-----97	320-----175	950-----274	4000-----351
30-----28	140-----103	340-----181	1000-----278	4500-----354
35-----32	150-----108	360-----186	1100-----285	5000-----357
40-----36	160-----113	380-----191	1200-----291	6000-----361
45-----40	170-----118	400-----196	1300-----297	7000-----364
50-----44	180-----123	420-----201	1400-----302	8000-----367
55-----48	190-----127	440-----205	1500-----306	9000-----368
60-----52	200-----132	460-----210	1600-----310	10000-----370
65-----56	210-----136	480-----214	1700-----313	15000-----375
70-----59	220-----140	500-----217	1800-----317	20000-----377
75-----63	230-----144	550-----226	1900-----320	30000-----379
80-----66	240-----148	600-----234	2000-----322	40000-----380
85-----70	250-----152	650-----242	2200-----327	50000-----381
90-----73	260-----155	700-----248	2400-----331	75000-----382
95-----76	270-----159	750-----254	2600-----335	100000-----384

Source: Krejcie and Morgan (1970)

Appendix V: Research Permit