

**FACTORS INFLUENCING INTEGRATION OF INFORMATION AND
COMMUNICATION TECHNOLOGY IN LEARNING AND TEACHING IN
PUBLIC SECONDARY SCHOOLS: A CASE OF TIGANIA WEST SUB
COUNTY, MERU COUNTY, KENYA.**

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DECLARATION

This research project is my original work and has not been presented for award of degree in any other university

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DEDICATION

This work is dedicated to my wife Joan Gikundi, who gave me moral support throughout the course.

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LIST OF ABBREVIATIONS AND ACRONYMS

ICT:	Information and Communication Technology
IJEDICT:	International Journal of Education and Development Using Information and Communication Technology
ITD:	Innovation Diffusion Theory
K.I.E:	Kenya Institute of Education (now known as KICD)
KEMI:	Kenya Education Management Institute
KICD:	Kenya Institute of Curriculum Development
MoE:	Ministry of Education
NACICTIE:	National Centre for ICT Integration in Education
NCTE :	National Council for Technology in Education
OLPC:	One Laptop Per Child
OLPCA:	One Laptop Per Child Association
SPSS:	Statistical Package for Social Sciences
UNESCO:	United Nations Educational, Scientific and Cultural Organization
USA:	United States of America

ABSTRACT

This study was aimed at examining factors influencing ICT integration in teaching and learning in public secondary schools in Tigania west Sub County. The variables of the study were availability of ICT infrastructure, technical support and teacher competence in ICT. The study used descriptive survey research design since the researcher was interested in finding out the characteristics of the population as it was. The target population was all the public secondary schools in Tigania West Sub County, Meru County. In that study the target population was 14,444 which included 44 head teachers, 400 teachers and 14000 students. Ten percent was used as the determinant of the sample size. In that case the sample size was four head teachers, 40 teachers and 1,400 students. The number of student was still large. According to Kathuri and Pals, (1993) a sample size of 100 is acceptable as long as none of the sub groups in the sample is less than 20. The latter method of determining the sample size was adopted as far as students are concerned. Consequently, 100 students were the students' sample size thus making the whole sample to be 144 (4 head teachers, 40 teachers and 100 students). The methods of data collection were questionnaires for teachers and students. Interview guide was also used with principals. Observation was also used to check physical presence of ICT facilities. The computer programme, SPSS version 17 was used to enhance efficiency in the quantitative data analysis. Results of this data analysis were presented using frequency distribution tables. Qualitative data was analyzed qualitatively using content analysis of meanings and implications emanating from respondents' information. The results were then reported in descriptive narratives. Regression analysis was done to determine the influence of the dependent variables on the independent variable. The three variables: availability of ICT infrastructure, teacher competence, and technical assistance were found to significantly influence integration of ICT in teaching and learning in the sampled schools. The study concluded that effective integration of technology into classroom practices poses a challenge to teachers. The factors that influenced integration of ICT were teacher competencies in ICT, institutional factors related to ICT infrastructure and technological factors. Teachers' training, knowledge and skills in ICT influence their use of ICT in teaching and learning. In relation to ICT infrastructure, absence of ICT infrastructure, old or poorly maintained hardware, lack of suitable educational software; limited access to ICT, lack of or unreliable internet connectivity were found to be hindering integration of ICT. In regard to technical support, this study established that most schools had no computer technicians. The study recommended that schools should develop strategies to identify strengths and weakness of various technological resources with a view to adopting ICT in the process of teaching and learning. The schools should source for partners to finance the acquisition of more ICT infrastructure and lessen the workload of teachers so as to enable them find time to learn and integrate ICT. The study further recommended schools to provide teachers with regular trainings and seminars on how to adopt ICT in the teaching and learning process, as well as adopt policies that guide structured integration of ICT in the process of teaching and learning.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Many scholars currently view information and communication technology (ICT) as a key mover in the education sector. Lim (2006) points out that information and communication technology coupled with the necessary pedagogical strategies engage students in higher order thinking. The primary motivation of integrating ICT in education is the belief that it supports students in their own constructive thinking and allows them to transcend their cognitive limitations and engage them in cognitive operations that they may not have been capable of otherwise (Salomon, 1993).

In response to demand for ICT as a gateway to learning the 21st century skills, many countries in the world have greatly invested in ICT to improve teaching and learning. The government of the United Kingdom spent £2.5 billion on education ICT between 2008-2009 (Nut, 2010). In the New Zealand, the government spends over 841 million on schools ICT infrastructure (Johnson, cavlert & Raggeb, 2009).

In Africa, a lot has been invested on research to monitor integration of ICT in teaching and learning in African schools. An example is a research carried out in Kenya by Gakuu and Kidombo (2008) and entered in the pan African observation on ICT in Africa.

In Kenya, policy framework for mainstreaming ICT in schools has already been formulated in the form of sessional paper no 14 of 2012. This document is the means by which the ministry of education affirms commitment to enhance access to education, promote equity and increase transition rates in its quest to provide quality education. The policy underscores the ministry's commitment to competency based teaching and learning that promotes acquisition of 21st century skills and attitudes

such as critical thinking, creativity, communication, collaboration and innovation that prepares the learners to competitively participate in a knowledge based economy. Integrating ICT at all levels of subjects and education is encouraged to enhance 21st century learning skills (ministry of education, 2012).

The social pillar of the vision 2030 also mandates the Kenyan ministry of education to provide quality education that produces highly skilled human capital with the requisite ICT skills to competitively participate in knowledge based economy. ICT is identified as a catalyst to drive social economic transformation of Kenya into a middle income country. However there are several challenges facing the achievement of vision 2030 which are high levels of poverty, limited rural electrification, frequent power disruptions, high cost of internet provision, high cost of ICT equipment and inadequate ICT infrastructure and support. (Ministry of education, 2012).

In Meru county and its sub counties, since the introduction of Economic Stimulus Program in 2012 through funding of selected schools, no monitoring or evaluation has been done. Schools have since been left on their own as far as use of ICT is concerned.

Hennessy, Harrison and wamakule (2010) argue that teacher development is a crucial component in enabling students to go beyond the subject knowledge and create their own knowledge. The teachers' ability coordinates their sophisticated professional skills with the pervasive use of technology. This in turn supports students who in the use of ICT are creating knowledge products while engaged in planning and managing their own learning goals in school. Teachers' model the learning process for students and serve as model learners through their ongoing professional development both individually and collaboratively (Hennessy et al, 2010). Kidombo, (2012) also indicates that ICT competence of the school manager was a key factor in the

integration of ICT in learning. Similar findings had earlier been done by other studies such as Keiyoro (2010); Afshari (2008) and Baas (2003).

1.2 Statement of the Problem

Kenya's education system is undergoing reforms to align itself with vision 2030 and the new constitution promulgated in 2010. A taskforce appointment in January 2011 to seek ways of realigning the education sector with the new constitution did a situational analysis and one of the statements in its report was that "only about 2% of schools in the country have the necessary ICT infrastructure" (Muriira, 2013). The taskforce recommended that institutional framework be strengthened to allow efficient integration of ICT in the entire education sector, with enhanced ICT capacity at all levels. It also recommended the establishment of a national centre for ICT integration in education (NACICTIE) with its functions devolved to counties.

According to Kidombo, Gakuu and Ndiritu (2012), the existing literature on ICT integration in education in Kenya appears to indicate limited knowledge on the quantity and quality of research in the area of pedagogical integration of ICT. Many scholars and practitioners have raised this as a major research need (Omwenga 2003; Keiyoro 2011; Gikonyo 2012). Recent studies have attempted to fill this gap especially in the African context which for a long time was assumed to have insignificant adoption of ICTS in education. For example Karsenti (2011) and Farrel and Issacs (2007) report that African countries have the least integration of ICT in education compared to other countries globally.

In Tigania west sub county seven selected schools were equipped in terms of infrastructure and capacity building in 2013, to enable them integrate ICT in teaching and learning. However information from the Sub county Director of Education's office indicates that no monitoring and evaluation of the ICT integration has ever been done in the sub county. The only report available is an assessment report for two schools dated 22/08/2012, which determined the suitability of the schools for ICT integration in teaching and learning. Since no follow up has been done since such schools were supported to integrate ICT in teaching and learning, there is need to find out the extent to which ICT has been integrated in teaching and learning not only in these supported schools but in any other schools in the Sub county that established

their own ICT infrastructure and sought training to enhance ICT integration in teaching and learning. This study therefore sought to determine the factors that influence ICT integration in teaching and learning in public secondary schools in Tigania west Sub County.

1.3 Purpose of the Study

The study sought to examine the factors influencing integration of ICT as a teaching and learning tool in public secondary schools in Tigania West Sub County.

1.4 Objectives of the Study

The study was guided by the following objectives:

- i. To examine how availability of ICT infrastructure influences integration of I.C.T in teaching and learning in public secondary schools.
- ii. To determine how technical support influences integration of ICT in teaching and learning in public secondary schools.
- iii. To determine how teacher competence in ICT influences integration of ICT in teaching and learning in public secondary schools.

1.5 Research Questions

The study sought to answer following research questions:

- i. How does the availability of ICT infrastructure influence integration of ICT in teaching and learning in public secondary schools in Tigania west Sub County?
- ii. How does technical support influence integration of ICT in teaching and learning in public secondary schools in Tigania west Sub County?
- iii. To what extent does teacher competence in ICT influence integration of ICT in teaching and learning in Tigania west Sub County?

1.6 Significance of the Study

The study was aimed at coming up with factors that enhance or prevent the integration of ICT as a teaching and learning tool in public secondary schools in Tigania west sub county which is a rural constituency. The findings of this study would assist in coming up with ways to strengthen ICT integration in teaching and learning in the sub county. The recommendations of the study would help other rural and even some urban constituencies to hasten the integration of ICT in educational institutions in line

with Kenya's vision 2030. This study was an awakening to the schools in Tigania West Sub County and other schools in the country to reassess their position as far as adhering to ICT policy as contained in sessional paper number 14 of 2012 is concerned. This self reevaluation would make them speed up ICT mainstreaming into their schools. The benefits of ICT integration would be easier delivery and evaluation of content by teachers, better comprehension of concepts and more access to learning materials by students and consequently better results leading to satisfaction of all stakeholders in education. It would also catalyze making of milestones towards achievement of vision 2030.

1.7 Limitations of the Study

The study used descriptive survey research design that attempts to describe the issue of interest systematically and objectively (Kothari 2002). Here a sample was methodically derived from the target population and the characteristics being studied were determined using various data collection methods. The findings were then generalized to apply to the entire target population and other populations with similar characteristics. The limitation of this research design is that only those characteristics singled out by the researcher are studied, in this case availability of ICT infrastructure, availability of technical support and teacher competence in ICT. The fact is that there are other factors influencing ICT integration in schools that were not to be covered by this study. Those factors found to be highly influencing integration of ICT in teaching and learning are recommended for further studies.

1.8 Delimitations of the Study

The study was carried out in Tigania west sub county public secondary schools which were forty four in number. Tigania west Sub County is in Meru County, Kenya. Sampling of respondents was done from sampled schools from among the total number of schools in the region. Teachers, principals and students of the sampled schools were targeted to provide the required data.

1.9 Assumptions of the Study

The study was carried out with the following assumptions:

Firstly that the respondents were willing to respond appropriately to the research instruments ,secondly that the problems facing ICT integration in schools in Tigania

west sub county were the same ones facing schools in other areas of Kenya and finally that the sampled schools and respondents were a good representative of the target population.

1.10 Organization of the Study

This study is organized into five chapters. Chapter one contains the background to the study, statement of the research problem, purpose of the study, objectives of the study research questions, significance of the study, delimitation of the study, limitations of the study, assumptions of the study and the organization of the study.

Chapter two contains literature review, theoretical and conceptual frameworks. Chapter three contains research design, research methodology, target population, sampling method and methods of data analysis. Chapter four contains data analysis, interpretation and presentation of the findings while chapter five contains the summary of findings, conclusions and recommendations.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This section deals with review of literature related to the factors influencing integration of Information and Communication Technology (ICT) in teaching and learning in public secondary schools: availability of ICT infrastructure, technical support and the competence of teachers in use of computers

2.2 Integration of ICT in Teaching and Learning

According to Lim (2006), research studies have shown that information communication technology (ICT) coupled with the necessary pedagogical strategies engage students in higher order thinking. The primary motivation for integrating ICT in education is the belief that it supports students in their own constructive thinking and allows them to transcend their cognitive limitations and engages them in cognitive operations that they may not have been capable of otherwise (Salomon, 1993). In this study ICT integration has been interpreted as 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 is used as a mediation tool in these activities to engage students in higher order thinking. 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 (Iowa Department of Education, 1989).

ICT integration in education is based on the activity theoretical framework. The activity theory originates from Soviet cultural-historical psychology (Leont’ev, 1981, Vygotsky, 1978) which was in turn rooted in both 18th and 19th century classical German philosophy-from Hegel’s idealism to the historical materialism of Marx and Engels, in which the concept of activity was extensively elaborated.

Human psychology was concerned with the activity of concrete individuals which takes place whether in a collective-that is jointly with other people-or in a situation where the subject deals directly with the surrounding world of objects-for example at the potters wheel or the writer’s desk. However, if we removed human activity from

the system of social relationships and social life it would not exist and would have no structure. With all its varied forms, the human individual's activity is a system in the system of social relationships. It does not exist without these relationships (Leont'ev, 1981).

Human activity is therefore socially bound. An individual never acts directly on or directly reacts to his/her environment but rather the activity that is undertaken by the individual to achieve the object of the environment is mediated by cultural means and tools and the dynamic nature of the activity. (Vygotskian (1978).

Taking an ICT mediated lesson in a school as an activity system, the subject is the student and the object is to understand the relationships among the variables found in an ICT mediated simulation package. A pool of ICT and non ICT tools, including the simulation package mediates the interaction between the subject and object. The students belong to the community consisting of his/her classmates, teachers and ICT staff governed by rules and division of labor. The rules include the school disciplinary rules and more specific ones like the procedures necessary for the simulation programme .For the division of labour, the students play the role of scientists gathering, representing, interpreting and analyzing data whereas the teacher takes a mediator role where he/she questions, clarifies, and summarizes to support students understanding of the relationships among the variables of the study. The concept of activity system provides a seminal formulation in a Vygotskian approach of a unit of analysis that serves as a starting point for a social-cultural approach towards the study of ICT in schools. "Real activities of real people over time" (Cole,1985) .Simply stated the activity theory advocated practical approach to teaching concepts and skills, which the proponents of the theory argue that it makes learning more feasible and promotes cognitive ability. Most countries in the world have already integrated ICT in their education systems and are only dealing with the challenges facing it.

According to Buabeng (2012) of the Pentecost University College of Ghana, many governments globally have made huge investments in ICT to improve teaching and learning in schools. However, Buabeng (2012) notes that despite the investments in ICT infrastructure equipments and professional development to improve education in many countries, ICT adaption and integration in teaching and learning has been

limited due to various factors which included personal, institutional and technological factors that encouraged teachers to use computer technology in teaching and learning processes. He also cited teacher level, school level and system level factors that prevent teachers from ICT use which included lack of teacher ICT skills, lack of teacher confidence, lack of pedagogical teacher training, lack of suitable education software, limited access to ICT, rigid structure of traditional education system and restrictive curricula. Knowing how each of these barriers affected individuals and institutions would help in taking a decision on how to tackle them.

Rangaswamy and Gupta (2000) describes adoption as the decisions that individuals make each time they consider taking up an innovation. Similarly Rodgers (2003) defines adoption as the decision of an individual to make use of an innovation as the best course of action available. Rodgers (2003) argues that the process of adoption starts with the initial hearing about an innovation to final adoption. Rodgers definition of adoption is the most appropriate for the purpose of this study.

Earle (2002) linked ICT integration with the concept of wholeness, when all elements of the system are connected together to become a whole. For example the two important elements of teaching and learning which are content and pedagogy must be joined when technology is used in a lesson. In other words if students are offered a series of websites or ICT tools (e.g. CD ROMS, multimedia, etc) then the teacher is not integrating ICT in teaching since he/she is not tackling the pedagogical issues. Williams (2003) described ICT integration as the means of using any ICT tools (internet, e-learning technologies, CD ROMS etc) to assist teaching and learning. For the purpose of this study the researcher used Williams's definition of ICT integration. According to David and Daugh 1 (1994), teaching using a computer programme is seen as interesting and the method of teaching ranges from drills, practice, simulations and tutorials. According to Elington (1993), any education software used to improve teaching and learning should integrate three aspects: technical quality, content related to curriculum and appropriate teaching methods (pedagogy). One of the most prominent changes in education systems around the world is the integration of information and communication technology (ICT) in teaching and learning practice. However, the management of educational change can be quite complex (Fulcan, 2007,

Louis 2006, Vujofofor (2007). In order to help integrate an innovation such as ICT into educational systems UNESCO proposes the following two dimensional model:

Model for marking the stages of ICT integration.

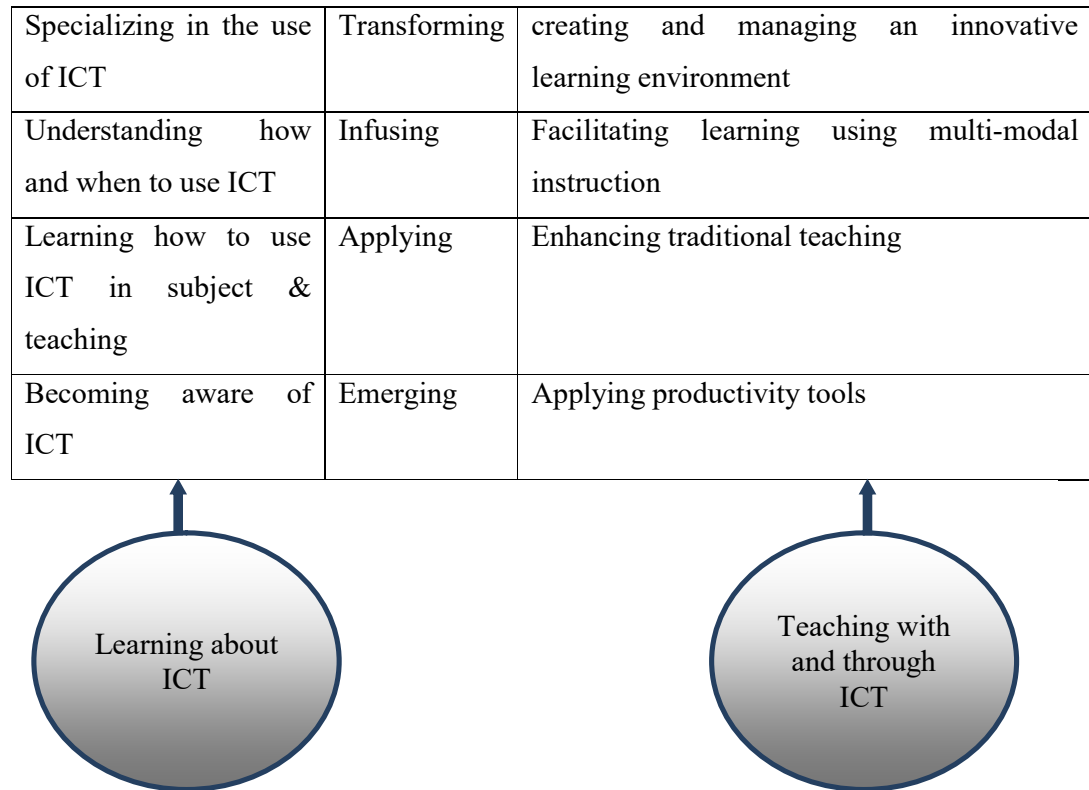


Figure 1: Model for marking the stages of ICT integration

Source: UNESCO, 2010

The purpose of this model is to enable institutions and individual stakeholders inside educational systems to determine the stage they are at. In that way they can make better decisions when it comes to, for example, allocating finances or improving teacher education programs. Thus educational institutions typically pass through levels ranging from emerging stages where computers have just been introduced to transforming where ICT is fully integrated into the institution and is broadly used on daily basis. Teachers and other stakeholders also go through stages from learning the basics about ICT use to integrating it in practice by teaching with and through ICT throughout the curriculum (UNESCO 2010). As such this model can be applied to an educational system with the purpose to provide general background and clarify the need for intervention.

According to Kelentric Marijana (2013) integration of ICT into an educational system is a special type of educational change. As such it is influenced by various factors that emerge inside educational stakeholders. Such factors are either internal or external depending on their source. External factors are those that are not under direct influence of the individual and exist outside of the individual's mind ,for example equipment, financial resources or technical support. On the other hand, internal factors stem from the individual's mind and individuals have control over them to some extent. These can be feelings, attitudes, perceptions or knowledge about ICT. Some of these factors also present obstacles to integration of ICT while others enable it. External factors are also referred to as non-manipulative or exogenous factors (Drent and Meelissen 2008), infrastructure (Pelgrum 2001), practical factors (Tearle, 2004) and facilitating conditions, (Teo, 2010). Among them the most prominent ones that appear in all reviewed studies and present the basis for ICT integration are the availability of hardware and software, access to them, their reliability, quality and quantity (Cuckle and Clarke,2002; Pelgrum,2001; Scrimshaw 2004; Stensaker et al, 2007; Tearlie, 2004; UNESCO, 2002a, 2002b; UNESCO, 2011). These material factors are followed by technical support which is seen both as technical support that includes assistance, guidance, advising and help with technical problems in ICT use, and support from the colleagues or school leadership in implementing ICT into the teaching process. (Cuckle and Clark, 2004; Drent and Meelissen, 2008; Pelgrum, 2001; Scrimshaw, 2004; Stensaker et al, 2007; Tearlie, 2004). Among factors found to influence integration of ICT in education is also management of ICT integration. It has been examined together with the coordination of ICT and people (Tearlier, 2004) or through the prism of written policies, curriculum development and the attitudes of leadership towards ICT (Pelgram, 2001; UNESCO, 2002a; UNESCO, 2011) A similar approach is also the one that explores the role of the government and commitment of institutional management to implementing ICT (Stensaker 2007, Drent and Meelissen 2008) as well as organization of access to ICT, (Scrmshaw, 2004). Funding is a factor that is considered very important in implementing ICT. It covers several areas among which are expenditures on teacher training (Pelgrum, 2001), availability of financial support (Drent and Meelissen, 2008) or economic resources in general (Stensaker 2007).

Another factor that belongs to the groups of external factors but it is not a material one is collaboration. It is perceived as inner information and communication system of the school and the collegial interaction and reflection (Drent and Meelissen, 2008). in a similar way UNESCO (2002a) recognizes collegiality, collaboration and networking as the consequences of ICT restructuring the social organization of the school, or it perceives collaboration as the community involvement into implementation of ICT (UNESCO, 2011). One more example of a non material factor is professional education, but it is also dependent on a material factor such as funding. It is seen as the availability of training and support (Scrimshaw, 2004, Tearlie, 2004) or as part of a broader category such as staff development (Pelgrum, 2001). It is also perceived as educational experience (Drent and Meelissen, 2008), an important component of ICT in educational policy (UNESCO, 2011) and implementation of ICT curriculum (UNESCO, 2002 a)

Not all studies that dealt with the external factors mentioned the internal ones. Those that did referred to them as manipulative or endogenous factors (Drent and Meelissen, 2008) and attitude and ethos (Tearlie, 2004). Thus attitudes towards ICT are analyzed by searching after general views on using computers (Cuckle and Clark, 2002), motivation and commitment towards ICT (Tearlie, 2004) and their influence on pedagogical approach and contribution to education (Drent and Meelissen, 2008). Cuckle and Clark (2002) also investigated attitudes of teachers towards colleagues who used ICT and those who did not. A different approach was presented by Teo (2010) who investigated the influence of perceived ease of use and perceived usefulness of ICT on teachers' attitudes towards ICT.

Further on, personal entrepreneurship invested into professional development (Drent & Meelissen, 2008) and collective Endeavour to implement ICT in teaching and learning processes (Tearlie, 2004) are also found important. When it comes to knowledge about ICT, Tearle (2004) and UNESCO (2002a), relate it to the understanding of how ICT is used and what its value is. Drent and Meelissen (2008) look at it as ICT competence and Scrimshaw is interested in the confidence, awareness of, and capability to use ICT.

The rapid growth in Information Communication and Technologies (ICT) have brought remarkable changes in the twenty-first century, as well as affected the demands of modern societies. 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 technological gap in teaching and learning. 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).

Global investment in ICT to improve teaching and learning in schools have been initiated by many governments. For example in the United Kingdom, the government spending on educational ICT in 2008–09 in the UK was £2.5bn (Nut, 2010), in the United States, the expenditure on K-12 schools and higher education institutions was \$6 billion and \$4.7 billion respectively in 2008-2009 (Nut, 2010) and in New Zealand, the government spends over \$ 410 million every year on schools ICT infrastructure (Johnson, Calvert & Raggert 2009). Despite all these investments on ICT infrastructure, equipments and professional development to improve education in many countries, Gulbahar (2007) claims that huge educational investments have produced little evidence of ICT adoption and use in teaching and learning especially in Turkey. Evidence suggests that the education sector is investing heavily on ICT but ICT adoption in education sector lags behind the business sector (Leidner & Jarvenpaa, 1995). Several surveys have been carried out to investigate the factors that are related to the use of computer technology in teaching and learning processes by teachers (Baek, Jung & Kim, 2008; Norton, McRobbie, & Cooper, 2000). As a classroom tool, the computer has captured the attention of the education community. This versatile instrument can store, manipulate, and retrieve information, and it has the capability not only of engaging students in instructional activities to increase their learning, but also of helping them to solve complex problems to enhance their cognitive skills (Jonassen & Reeves, 1996).

Generally, three objectives are distinguished for the use of ICT in education (Plomp, , Brummelhuis, & Rapmund, 1996): the use of ICT as an object of study, the use of ICT as an 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. Therefore, they must be able to prepare young people for the knowledge society in which the competence to use ICT to acquire and process information is very important (Plomp 1996).

2.3 Availability of ICT Infrastructure and Integration of ICT in Teaching and Learning.

Access to ICT infrastructure and resources in schools is a necessary condition to the integration of ICT in education (Plomp, Anderson, Law, & Quale, 2009). Mumtaz (2000) points out that lack of computers and software can seriously limit what teachers can do in the classroom with regards to integration of ICT. Access to ICT is a first and necessary step in the integration process even though mere access will not automatically lead to use of ICT for teaching and learning. 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 (Afe, 2002; Olekulehin, 2007).

A study by Yildirim (2007) found that access to technological resources is one of the effective ways to teachers' pedagogical use of ICT in teaching. Further a study of 814 faculty members in higher education in Turkey showed that majority of the respondents reported having access to computers and the internet. 82.5% and 81.2% of faculty members had access to computers and internet respectively (Usluel, Askar & Bas, 2008).

Also a quantitative study was conducted by Albirini (2006) to collect evidence from high school English teachers' views on computer attributes, cultural perceptions, computer competence, computer access, and personal characteristics. The respondents of the study were 63 male and 251 female teachers. The result revealed that 57% of the respondents had computers at home and 33.4% had access to computers at school. This is an indication of teachers' inadequate access to computers.

Further the National Centre for Education Statistics (2000) as cited in Afshari, Bakar, Luan, Samah, & Fooi (2009) report revealed that over 50% of the respondents used computers for research and lesson preparation in their schools. About 78% of the respondents complained of inadequate access to computers in the classroom. Of this percentage, 38% of the respondents stated that inadequate computers were not great barriers to ICT use in their teaching, but improved availability and fairness of access to technology resources by teachers, students and administrative staff was essential.

Access to hardware and software is not only important, but also the use of suitable kind of tools and programs to support teaching and learning (Tondeur, Valcke, & van Braak, 2008). "Access to appropriate technology means that affordability and constraints of a technological tool need to be carefully considered when the tool is incorporated in a lesson" (Friedhoff, 2008, cited in Chen, 2010) Also, it is necessary to make a distinction of access to ICT resources. For instance, in a study of pre service teachers by Dexter & Reidel (2003), revealed that 37.4% of the 144 teachers in IJEDICT had access to computers and 14.4% of the students had access to computers, implying that computers are more available to teachers than students. Obviously, to encourage student centered technology learning, it is necessary that learners have access to quality technology resources. Though it is the government policy to integrate ICT in learning in public secondary schools in Kenya, there is no money factored in the Free Day Secondary Education Funds for ICT integration. Also, only a few schools have been given ICT facilities, but even with them no monitoring and evaluation has been done to monitor ICT integration in teaching and learning. Otherwise, little is known about availability of ICT infrastructure in secondary schools in Tigania West Sub – County. This study therefore sought to examine how availability of ICT infrastructure influenced the integration of ICT in teaching and learning in public secondary schools in Tigania West Sub-County.

Goktas, Yoksel et al (2009), identified lack of software and lack of hardware as the main barriers for integrating ICT in pre service teacher education programs. Charles Buabeng – Andoh of the Pentecostal University College, Ghana in his article in the international journal of education and development using information communication technology (IJEDICT, 2012 Vol 8 Issue 1 pp136-155) highlights access to ICT infrastructure and resources in schools as a necessary condition to the integration of ICT in education. According to Plomp, Anderson, Law and 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 ICT in teaching and learning. A study by Yildirim (2007), found that access to technological resources is one of the effective ways to teachers' pedagogical use of ICT in teaching. Further a study of 814 faculty members in higher education in Turkey showed that majority of the respondents reported having access to computers and the internet. 82.5% and 81.2% faculty members had access to computers and the internet respectively, (Usluel, Aska, and Bas, 2008).

According to Albirini (2006), access to computer and network both at school and at home is important for teachers. He found insufficient computers and low access to the internet as barriers to integration of ICT into teacher training. According to Tondeur, Valcke and Van Braak, (2008), access to hardware and software is not only important but also the use of suitable kind of tools and programs to support teaching and learning.

Access to appropriate technology means that affordability and constraints of the same needs to be carefully considered when the technology tool is incorporated in a lesson. It is also necessary to make a distinction of access to ICT resource, for instance in a study of pre-service teachers by Dexter and Reidel (2003), revealed that 37.4% of the teachers had access to computers and 14.4% of the students had access to computers, implying that computers are more available to teachers than to students. Obviously to encourage student-centered technology learning, it is necessary that learners have

access to quality technology resources. According to (Gulati, 2008), the infrastructure required for ICT in teaching includes: physical space, furniture, electricity, and internet connectivity. Such infrastructure may be readily available in more affluent areas but is not automatically guaranteed in disadvantaged schools (Obijiofor, 2009).

According to Nyambane et al (2014), effective adoption and integration of ICT into teaching and learning in schools depends mainly on the availability and accessibility of ICT resources such as hardware, software etc. Cox, (1999a) found that teachers placed great importance in computer ownership and access to ICT for personal use as a factor that influenced their adoption of ICT in teaching practice. Becker's (2000) report of findings from teaching learning and computing survey; indicated that classrooms with access to local computer clusters or hubs were more frequently used in teaching and learning than computing laboratories. Similarly a study by Yildim (2007) found that access to technological resources was one of the effective ways to teachers' pedagogical use of ICT in teaching.

Empericas (2006) European study indicated that lack of access to ICT infrastructure was the largest barrier to ICT integration in teaching and learning. Pelgrum (2001) explored practitioners' views from 26 countries on what were the main obstacles to the implementation of ICT in schools. He concluded that four of the top ten barriers were related to accessibility of ICT. These barriers were: insufficient numbers of computers, insufficient numbers of copies of software, insufficient simultaneous internet access, and insufficient peripherals.

Toprakci (2006) found that low numbers of computers, oldness or slowness of ICT system and scarcity of educational software in schools were barriers to the successful implementation of ICT into science education in Turkish schools. Similarly Al-Alwani (2005) found that having no access to the internet during the school day and lack of hardware were impending technology integration in Saudi schools. According to Plomp, et al (2009), access to ICT infrastructure and resources in schools is a necessary condition to the integration of ICT in education.

According to Anderson (1997) barriers to use of ICT by teachers include :lack of reliable access to electricity, limited technological infrastructure especially internet

access, bandwidth, hardware and software provision, language of instruction and available software, geographical factors such as country size, terrain and communications, demographic factors such as population size, density and dispersion. The issue of access is further exacerbated by extreme poverty, growing prevalence of HIV /AIDS and lack of political will to alleviate the situation through proper planning. In addition, educational factors including levels of teachers' own education and literacy rates and access to professional development which also play an important role, (Plomp and Anderson, 1997).

According to Gulbahar (2005), using up to date hardware and software resources is a key feature to diffusion of technology. Gulbahar (2005) adds that in recent years most schools are equipped with different kinds of technological infrastructure and electronic resources available. For instance one Australian school reported that it has provided personal note books, computers and their own web spaces, email access and workspace for all staff and students from years 5 onwards. Video conferencing is available and the school has established intranet, placing all its resources online. These are accessible via radio connections from school and home. In this school the use of radio is seen as an innovation that has completely changed the nature of teaching and learning (Richardson, 2000). Also, Richardson (2000) reported that many teachers integrated technology into their teaching and learning processes in the school. This awareness appeared when they saw the potential of on-line lessons and the possibility of creating shared net based teaching materials. Therefore hardware, software and network infrastructure must be available to integrate ICT in education. Appropriate resourcing and flexible forward looking planning, linked closely to what teachers actually want and need at any given stage will be essential.

According to Kidombo et al (2012) acquisition of a limited number of computers initially by schools for management purposes appears to have created conditions necessary to introduce, albeit gradually, integration of ICT in teaching and learning . it could be argued therefore that once management adopts ICT in its practices it diffuses and spreads to other institutional members and they become interested in its use. As such even without a plan or designed way of integration some teachers with the inclination and interest in ICT end up finding innovative ways of using it to enhance their teaching capacities. Initially it may be used for recording and analyzing

marks, typing lesson plans and eventually actual teaching and learning by searching for information and displaying learning content. Given the opportunity and access, learners are equally able to use ICT to enhance their learning (Kidombo 2012).

From the above literature review it is therefore clear that access to computers, updated software and hardware are key elements to successful adoption and integration of information and communication technology in teaching and learning. Lack of access to ICT infrastructure is the main barrier to ICT integration in teaching and learning in public secondary schools in Tigania west Sub County; because almost 100% of the schools lack sufficient computers and software. Majority of the schools have no internet hence limited use of ICT. Others lack space for ICT use e.g. classrooms and computer laboratories. A few have no electricity (Sub county director of education, Tigania west). The findings of other researchers quoted in this literature review are true to Tigania west Sub County. There is need to ascertain the extent to which lack of ICT infrastructure has hampered integration of ICT in teaching and learning, in the specific context of Tigania west sub county, in order to be able to make workable recommendations.

2.4 Technical Support and Integration of ICT in Teaching and Learning

Jones (2004) indicates that the breakdown of a computer causes interruptions and if there is lack of technical assistance, then it is likely that the regular repairs of the computer will not be carried out resulting in teachers not using computers in teaching. The effect is that teachers will be discouraged from using computers because of fear of equipment failure since no one would give them technical support in case there is a technical problem.

Becta (2004) agreed that “if there is a lack of technical support in a school, then it is likely that technical maintenance will not be carried out regularly, resulting in a higher risk of technical breakdowns” (p.16). In Ireland, the National Council for Technology in Education, NCTE 2005 census on ICT infrastructure (as cited in ICT strategy group report, 2008-2013) found that about 85.3% of schools reported technical support and maintenance as a ‘high’ or ‘very high’ priority and claimed that it should be an important element of the school ICT environment with proper technical support being made available to maintain hardware and infrastructure.

Similarly, Yilmaz, (2011) in assessing the technology integration processes in the Turkish education system indicated that in providing schools with hardware and internet connections, it is also crucial to provide the schools with technical support with regard to repair and maintenance for the continued use of ICT in schools. Therefore, if there is no technical support for teachers, they become frustrated resulting in their unwillingness to use ICT (Tong & Trinidad, 2005).

One way in which schools can move to student centered use of ICT, is through links with the wider community. Such links enable the development of a more authentic and contextualized approach to learning supported by ICT tools (Dementriadis 2003). Thus human responsibility, roles and priorities within the community must be rearranged. For example, assessment methodologies should be redesigned to allow all interested community members to play an appropriate role.

In this respect, Granger (2002) studied four schools to identify factors contributing to successful implementation of ICT by teachers. Based on their findings, they concluded that successful implementation required not only computers but also commitment and communal support. Community support and commitment were found to be closely interlinked.

For technical support of ICT integration in teaching and learning to be effective the school must have a strategy for maintenance and renewal of ICT equipment. A study by Kidombo et al (2012) found that out of ten schools only five had a strategy for maintenance and renewal of ICT equipment while the rest indicated they did not have. Two schools had a three year contract with Computers for Schools Kenya, an organization supported by the government to equip schools all over the country with refurbished computers and to maintain them. The schools pay the organization Kenya shillings 3000 per year for maintenance. Another school felt that they did not need a service contract and instead relied on the computer teacher. The ICT teacher was very competent in the use of ICT and maintained, serviced and installed new software in the computers. If the problem was beyond his ability he advised the school management to contract an expert to deal with it. This arrangement seems to have increased the workload of the ICT teacher who is also expected to teach.

Even though, lack of technical support discourages teachers from adopting and integrating technology in classrooms, a study by (Korte & Husing, 2007) revealed that schools in Britain and the Netherlands have appreciated the significance of technical support to help teachers to integrate technology into their teaching. They argue that ICT support in schools influence teachers to apply ICT in classrooms without wasting time with troubleshooting hardware and software problems. Little is known about ICT technical support in secondary schools in Tigania West Sub – County. This study therefore sought to determine how technical support influenced the integration of ICT in teaching and learning in public secondary schools in Tigania West Sub-County.

2.5 Competence of Teachers in Use of Computers

According to Bodbar (2010), Use of computer technology in teaching and learning is one of the modern methods of instruction. The teacher happens to be the key to its effective implementation. However, this is not the case because of the dynamism in computer technology and its usage. Computer competence is defined as being able to handle a wide range of varying computer applications for various purposes (van Braak 2004). According to Bordbar (2010), teachers' computer competence is a major predictor of integrating ICT in teaching. 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 more “informed decision” (Bordbar, 2010).

In a qualitative multiple case-study research on primary school competence and confidence level regarding the use of ICT in teaching practice conducted in five European countries, Peralta & Costa (2007) found that technical competence influenced Italian teacher's use of ICT in teaching. However, the teachers cited pedagogical and didactic competences as significant factors if effective and efficient educational interventions are likely to be implemented. In Portugal, teachers reported different views regarding the most important competences for teaching with ICT. The experienced and new teachers stressed the need for technical skills and attitude, the innovative teachers emphasized curricula and didactic competences and the student-teachers cited technical competence and pedagogical efficiency as significant to integrate ICT in teaching and learning processes. According to Peralta & Costa (2007) teachers with more experience with computers have greater confidence in their ability

to use them effectively. Jones (2004) reported that teachers competence relate directly to confidence. Teachers' confidence also relate to their perceptions of their ability to use computers in the classroom, particularly in relation to their student's perceived competence.

In Kenyan secondary schools, teachers are either employed by the BOM or posted directly by the TSC. Their training may not have included ICT skills hence their inability to use the technology. This is further complicated by insufficient technical assistance and insufficient and inefficient number of computers. Poor lesson preparation by teachers due to overload whereby little time is allocated for practice can also be blamed for causing ineffectiveness when teaching with computers.

Askim (2003) reviews the perspectives and awareness levels of specific technologies among teachers and confirms that lack of computer expertise causes low levels of technical knowledge. He further reiterates that teachers' incompetence is due to lack of training and insufficient training opportunities. In secondary schools there are no in service programs for computer literacy facilitated by the MOE or the schools themselves unlike the SMASSE project. Lack of research into possible options for policies and strategies towards teaching using computer technology and teachers perceptions on the use of computer in teaching of the curriculum all form part of the problems encountered by the teachers. In this regards, the researcher is prompted to find out how incompetence among teachers leads to inefficient use of computer technology in teaching and learning.

According to Pelgrum (2002), many school leaders perceive the lack of ICT related knowledge of teachers as a major obstacle to the realization of their ICT related goals. Identifying the competencies that each teacher needs to acquire in order to integrate ICT in teaching, is far from simple; as this depends very much on the circumstances of their particular school (Pelgrum, 2002). Personal teaching styles also play a major role. Again one size fits all does not work when prescribing ICT competencies (Davis Preston & Sahin, 2009). We also need to recognize that substantial learning can take place while teaching and even learning from students.

The UNESCO (2008), ICT competency standards for teachers go further describing three approaches: technological literacy, knowledge deepening and knowledge

creation. These approaches are seen as part of a development continuum and each approach has different implications for educational reform and improvement plus different implications for changes in the components of the education system. These components include: pedagogy, teacher practice, professional development, curriculum assessment, school organization and administration. ICT plays a unique but complimentary role in each of these approaches with new technologies requiring new teacher roles, new pedagogy and new standards of teacher education. The successful integration of ICT into the classroom depends on the ability of teachers to structure their learning environment in non traditional ways merging technology with new pedagogies. This requires a very different set of classroom management skills to be developed together with innovative ways of using technology to enhance learning and encourage technology literacy, knowledge deepening and knowledge creation.

At the knowledge creation end of the continuum, the curriculum goes beyond focus on subject knowledge to explicitly include 21st century skills that are needed to construct new knowledge and engage in life long learning- the ability to collaborate, communicate, create, innovate and think critically (Sara Hennessy et al., 2010). Teacher development is seen as a crucial component here. It ideally coordinates teachers' sophisticated professional skills with the pervasive use of technology. This in turn supports students who are creating knowledge products, and who are engaged in planning and managing their own learning goals in a school that is a continuously improving learning organization. Teachers model the learning process for students and serve as model learners through their on- going professional development both individually and collaboratively (Hennessy, Harrison & Wamakote, 2010).

According to Tondeur et al (2008) computer competence is defined as being able to handle a wide range of varying computer applications for various purposes. The success of educational innovations depends largely on the skills and knowledge of teachers (Pelgrum, 2001).

Teachers' lack of knowledge and skill was the second most inhibiting obstacle to use of computers in schools (Pelgrum et al, 2003). Similarly in the United States, Knezek and Chritersen (2000) hypothesized high levels of attitude, skill and knowledge (proficiency) and tools (levels of access) would provide higher levels of technology

integration that would reflect on student achievement positively. Their model postulated that educators with higher levels of skill, knowledge, and tools would exhibit higher levels of technology integration in class. Therefore teachers should develop their competence based on educational goals they want to accomplish with the help of ICT. Evidence suggest that majority of teachers who reported negative or neutral attitude towards integration of ICT into teaching and learning lacked knowledge and skills that would allow them to make more informed decisions, (Bordbar, 2010).

In a qualitative multiple case study, research on primary school competence and confidence level regarding the use of ICT in teaching practice conducted in European countries, Peralta and Costa (2007) found that technical competence influenced Italian teachers' use of ICT in teaching. However the teachers cited pedagogical and didactic competencies as significant factors if effective and efficient educational interventions are likely to be implemented. In Syria for example teachers' lack of technological competence has been cited as the main barrier (Albirini, 2006). In Australia, Newhouse (20002) found that many teachers lacked the knowledge and skills to use computers and were not enthusiastic about the changes and integration of supplementary learning associated with bringing computers into their teaching practice.

Jones (2004) reported that teachers' competence related directly to confidence. Teachers' confidence also relates to perceptions of their ability to use computers in a classroom, particularly in relation to their students' perceived competence. Hence lack of teacher competence may be one of the strong barriers to the integration of technologies into education. It may also be one of the factors involved in resistance to change, (Hennesy, 2010).

A study done by Laronde (2010) indicates that one of the basic skills in effective computer use is keyboarding. The proficiency in developing any skill including fine motor skills such as writing with a pencil or keyboarding is practice. Skill also requires being taught with an effective technique supervised by someone who follows a proven method of proficiency, (Rodgers, 2006). The computer has the capability of being used with or without a low level keyboarding skills but to conduct studies

without addressing the prior keyboarding skills of the students limits the potential benefit of the computer. Of the many studies that have been done on the computer, keyboarding is only indirectly considered. (Laroude, 2010). UNESCO (2002) recognizes the importance of keyboarding as a skill to be learned by students if they are to work in any professional environment.

UNESCO (2002) came up with model of ICT integration in teacher education and gave the competencies required for its implementation.

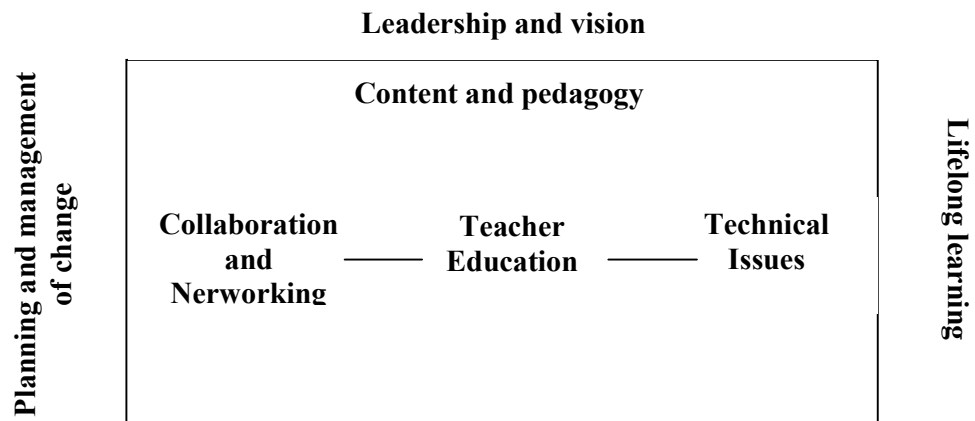


Figure 2: UNESCO model of ICT in teacher education: a model framework for ICTS in teacher education (UNESCO, 2002, p 41)

Four ICT competencies required for the implementation of this model are: pedagogy which is focused on teachers’ instructional practices and knowledge of the curriculum and requires that they develop applications within their disciplines that make effective use of ICTs to support and extend teaching and learning.

According to Kidombo Gakuu and Ndiritu (2012) the competence of the school principal is key for establishing and maintaining a learning environment compatible with student centered approaches to teaching and learning with ICT. They are also seen as curriculum and pedagogy leaders and are considered by stakeholders as central figures in leading the process for creating the conditions to teach and learn with ICT. The competence of the school manager in the use of ICT and a broad

understanding of the technical, curricular, administrative, financial and social dimensions of ICT use in Education is important to the effectiveness and sustainability of ICT integration programmes (Kidombo et al 2012)

The study done by Kidombo (2012) indicate that only one out of ten principals had a higher diploma in ICT while the rest had either no skills or just basic knowledge. Similar findings had earlier been arrived at by other studies such as Keiyoro (2010); Afshari et al (2008) and Baas et al (2003).

Collaboration and networking is another competency which acknowledges the communicative aspect of ICT to extend learning beyond the classroom and the implications for the teachers' development of new knowledge skills. Technology brings with it new rights and responsibilities including equitable access to technology resources, care for individuals health, and respect of intellectual property included within social issues-aspect of ICT competence. Finally, technical issues is an aspect of lifelong learning theme through which teachers update skills with hardware and software as new generations of technology emerge (UNESCO, 2002 p 41). The above information from UNESCO (2002) implies that all institutions wishing to integrate ICT in teaching and learning need to equip the teachers with the four competencies either through pre-service or in-service training and keep them updated on technological or social change through capacity building as need arises. This study aimed at determining the extent of the influence of teacher competence in the integration of ICT in teaching and learning in Tigania West schools.

2.6 Theoretical Framework

Rogers Innovation Diffusion Theory (IDT)

Quaddus and Hofmeyer (2006) explained that studies on organizational innovation adoption found that adoption occurs in two stages. The first stage is defined as the initiation stage, which is followed by the implementation phase. In the initiation stage, the organization develops an awareness of the innovation, forms an attitude towards it and evaluates the innovation. The actual adoption decision was found to occur between the initiation and the implementation phases. According to London (2006), this transition from knowledge of the innovation to its implementation is measured as a sequential process which encompasses the innovations rate of adoption. The

adoption process may be affected by the type of innovation decision being made, which maybe collective/organizational and authoritarian/hierarchical. On the other hand diffusion is the process by which an innovation is communicated through certain channels over time among the members of a social system (El-hadary, 2001). Quaddus and Hofmeyer (2006), defined Rogers (1995) innovation theory as an idea or practice that is perceived as new by the adopting organization. Braun (2004) argued that Rogers Innovation Diffusion Theory (IDT) analyzed the process of diffusion, and mapped the impact of a combination of social, economic, and technical forces on that process.

There is a general agreement among researchers that IDT is a suitable and valid theory for examining the process of adoption. In a research conducted by Jeyaraj, Rottman and Lacity (2006) on adoption of information technology by individuals and organizations, IDT was recognized as the only theory which has been used to evaluate adoption on the individual and organizational level. Looi (2004) stated that Rogers' theory is considered valuable because it attempts to explain the factors which influence the adoption of an innovation and the manner in which new innovations are disseminated through social systems over time. El-hadary (2001) emphasized that one of the major contributions of IDT was the innovation decision process, which starts with one's knowledge about the existence of the innovation and ends with the confirmation of the adoption/rejection decision. Aghaunor and Fotoh (2006) outlined the following as components of IDT:

Relative Advantage: The degree to which an innovation is perceived as being superior to its predecessor in terms of economic profitability, low initial cost, a decrease in discomfort, savings in time and effort, and the immediacy of the reward. Gemino, mackay and Reich (2006) highlighted that relative advantage is expressed by perceived benefits. Aghaunor and Fotoh (2006) elaborated that the perceived benefits for managers could be direct, such as cost savings or income generation, or indirect, such as potential opportunities in new markets, marketing, or publicity. Gemino (2006) conveyed that research has found that relative advantage is the primary reason for encouraging ICT growth and a positive relationship has been identified between perceived advantages and adoption.

Compatibility: The degree to which an innovation is perceived as being compatible with existing beliefs, experience and needs of potential adopters. A faster rate of adoption occurs when an adopter perceives an innovation as meeting the needs of the client. Alam, Khatibi, Ahmad and Ismail (2007) stated that an innovation is more likely to be adopted if it is compatible with individual job responsibility and value system. Alam et al (2007) affirmed that organizations should determine the needs of their customers and then recommend innovations that fulfill those needs. It is therefore anticipated that as needs are met the adoption will occur.

Complexity: the degree to which an innovation is perceived as being relatively difficult to understand and use. The perceived complexity of an innovation is negatively related to its rate of adoption. Alam et al (2007) reported that previous studies on the adoption of innovations indicated that the adoption of complex technologies require organizational personnel to possess sufficient technical competencies.

Trial ability: The degree to which an innovation can be used on a trial basis before confirmation of the adoption must occur. Rogers' (1995) studies found that "the trial ability of an innovation, as perceived by members of a social system, is positively related to its rate of adoption. Alam et al (2007) suggested that trial ability has become an important feature of innovation because it provides a means for prospective adopters to reduce their uncertainties regarding unfamiliar technologies or products.

Observability: The degree to which the potential adopter perceives that the results of an innovation are visible to others. Displaying an innovation's superiority in a tangible form will increase the adoption rate.

2.7 Conceptual Framework

Figure 3 shows the relationship between the dependent and independent variables of the study

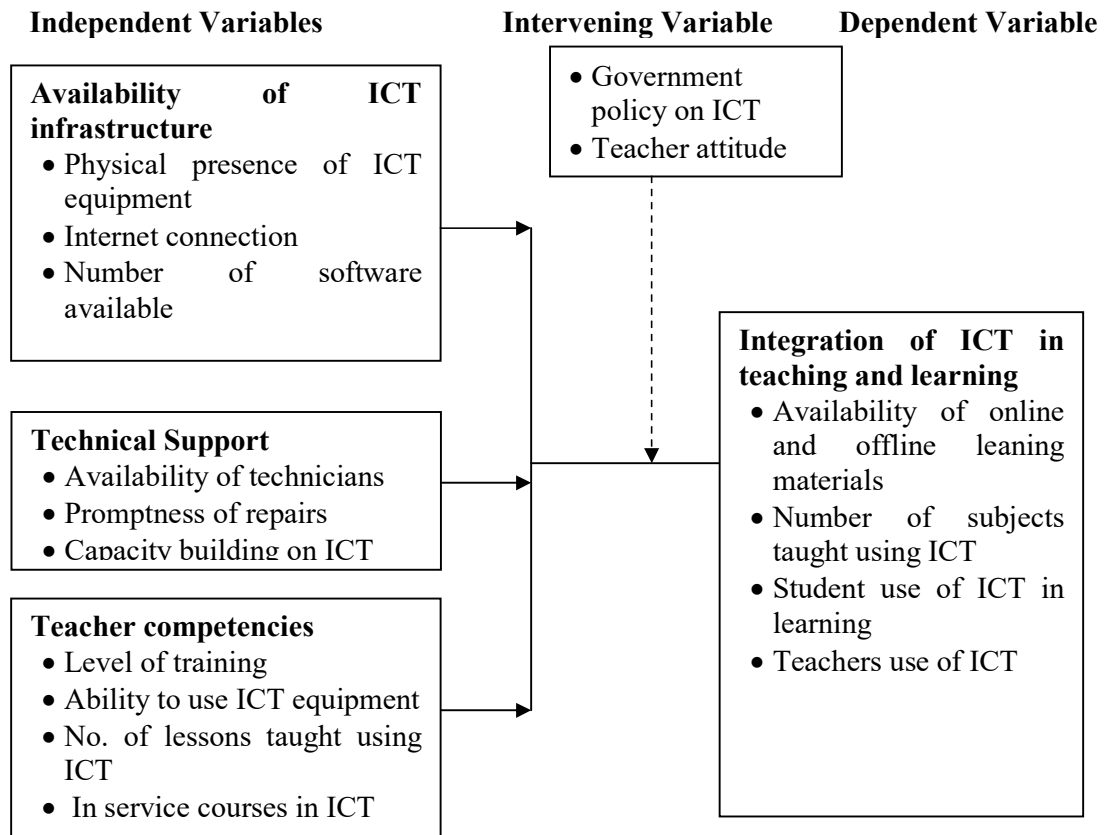


Figure 3: Conceptual framework

In this figure, the competence of teachers in the use of ICT will influence the utilization of the ICT in public secondary schools whereby this will be realized if the teachers are equipped with the required skills.

Availability of adequate infrastructure in ICT will make the utilization convenient. This will be ensured by government provision of ICT equipments which are enough for use in public secondary schools.

Maintenance of ICT equipments at school is very important. There should be a safe storage facility and a computer or ICT technician for the purpose of repairing and

ensuring these equipment are regularly used in teaching and learning in secondary schools.

Positive attitude of both teachers and students is very important because it will create interest for them and influence use of ICT or computers in teaching and learning even during their own time. The government should ensure teachers are trained on ICT skills at college and those in the field are taken for ICT workshops as this will enable them to have effective utilization of ICT in public secondary schools without challenges.

2.8 Summary of Literature Review and Research Gaps

This chapter has dealt with the concept of ICT integration in learning and teaching in public schools. It has also featured literature review on three factors influencing ICT integration in teaching and learning which are availability of ICT infrastructure, technical assistance and teacher competence in ICT. A few research gaps have been identified in this literature review. Kidombo (2012) indicates that the existing literature on ICT integration in education in Kenya appears to indicate limited knowledge on the quality and quantity of research in the area of pedagogical integration of ICT. There was no study or even assessment done in Tigania west public schools to indicate how availability of ICT infrastructure, technical support and teacher competence influence ICT integration in teaching and learning in public secondary schools in the sub county. Information from the Sub County director of education's office indicated that the only assessment done on a few schools was aimed at determining the suitability of such schools for ICT integration. That assessment was done on 22/8/2012. No follow up has been done since then. The literature available on ICT integration in Kenyan schools is mostly based on schools within Nairobi and its environs. There is usually a developmental gap between rural and urban schools. There is therefore a need to do studies on ICT integration in rural public schools.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This section gives an outline on the procedures and methods the researcher used in this study. The section comprises of the research design, the study population, sample and sampling techniques, instrumentation, ethical consideration, data collection procedures and the methods of data analysis.

3.2 Research Design

The researcher used a descriptive survey research design. Lokesh (2004) indicates that descriptive survey is conducted to collect detailed description of existing phenomenon with the intent of employing data to justify current conditions and make recommendations for improving them. The use of descriptive survey was preferred because the researcher's intention was to find out the factors influencing integration of ICT as a teaching and learning tool in public secondary schools in Tigania West Sub - County, Meru County. This research design was used because of its appropriateness in establishing issues as they are.

3.3 Target Population

The study population consisted of 44 public secondary schools within the sub county with an average of 400 teachers, 44 head teachers and 1,400 students.

3.4 Sample Size and Sampling Techniques

According to Gay (1992), at least 10% of the population is a good representation where the population is large and 20% where the population is small. In this study the target population was 14,444 which included 44 head teachers, 400 teachers and 14,000 students. Ten percent was used as the determinant of the sample size. In that case the sample size was four head teachers, 40 teachers and 1,400 students. The number of students was still large. According to Kathuri and Pals, (1993) a sample size of 100 is acceptable as long as none of the sub groups in the sample is less than 20. The latter method of determining the sample size was adopted, as far as students were concerned. Consequently, 100 was picked as the students' sample size thus making the whole sample to be 144 (4 head teachers, 40 teachers and 100 students). The four head teachers were selected using simple random sampling while the rest of

the sub samples were selected using simple random sampling from the schools headed by the four head teachers. Table 1 indicates a summary of the sample size.

Table 3.1: Sample size

Respondents	Total Population	Sample Size
Head teachers	44	4
Teachers	400	40
Students	14000	100

3.5 Instruments for Data Collection

Questionnaires, interview schedule and observation schedule were the data collecting instruments. Questionnaires were used since they were convenient in terms of time. Questionnaires also presented an even stimulus to a large number of respondents simultaneously and provided the investigation with an easy accumulation of data (Gay, 1992). According to Orodho (2002) questionnaires are the most suitable instruments for data collection where large numbers of subjects are involved in a study. Use of questionnaires is anonymous and helps to produce more candid responses than is possible in an interview. There were two sets of questionnaires; the teachers' and students' questionnaires. An interview guide was used to collect data from head teachers. The interview schedule consisted of two sections. The reason for interviewing principals is that they were the overall overseers of teaching and learning process in the schools and were able to give facts which hindered full use of ICT in teaching and learning.

The observation schedule intended to investigate the availability of computer hardware, software and computer peripherals. It consisted of a list of computer hardware, software and peripherals that would guide the researcher in observation.

3.6 Pilot Study

The data collection instruments were first used to collect data from two secondary schools in the neighboring Tigania East sub county. Those schools were not included in the actual research.

3.7 Reliability of the Instruments

Reliability refers to the degree to which instruments yield consistent data or results after repeated trials (Mugenda and Mugenda, 2003). To assess the reliability of the data collected, the researcher employed test – retest technique in which the instruments were administered twice to similar subjects. The initial data collected was a pilot test of the instruments to ensure that they obtained the desired data or results. This pilot study was done in two schools in Tigania East Sub County randomly selected to pre-test the instruments. The instruments were administered to the respondents and the process repeated after two weeks. Pearson’s product moment correlation was used to establish reliability. The instruments were judged reliable after they yielded a reliability coefficient of 0.81.

3.8 Validity of the Instruments

Validity refers to the degree of accuracy and meaningfulness of inference based on research results. Validation of the data was done using content validity. This measured the degree to which data collected using a particular instrument represented a specific domain of indicators or content of a particular concept (Mugenda and Mugenda, 1999). The indicators of variables were clearly defined and scrutinized and instruments developed to match the study objectives and they were also aligned with the conceptual frame work. For validity of the instruments to be ensured, the instruments were given to experts at the University of Nairobi for scrutiny. Any changes deemed suitable was made through the advice of the experts. The results of the pilot study were used to identify areas of strength and weakness. This enabled the researcher to make corrections before the actual study took place. The results further helped to know about validity and reliability of the instruments used.

3.9 Data Collection Procedure

The researcher sought permission from the County Director of Education-Meru County, Sub County Education Director – Tigania West Sub-County and the head teachers from the schools where the research was done. The researcher then visited the schools for familiarization and introduction .On the second visit the researcher distributed, administered and collected the questionnaires to avoid the respondents discussing among themselves. He also interviewed the principals observed the ICT tools in the computer rooms.

3.10 Methods of Data Analysis and Presentation

After all data was collected, the researcher conducted data cleaning to remove outliers or unfilled questionnaires and categorized data manually according to the questionnaire items and then the data was coded. The quantitative data was analyzed using frequency counts, means and percentages. The computer programme, SPSS (Statistical Package for Social Sciences) version 2.0 was used to enhance efficiency in the quantitative data analysis. As Martin and Acuna (2002) observes, SPSS programme is able to handle large amounts of data and given its wide spectrum of statistical procedures purposely designed for social sciences, it is also quite efficient. The result of this data analysis was presented using frequency distribution tables and percentages. Qualitative data was analyzed qualitatively using content analysis of meanings and implications emanating from respondents' information. The results were then reported by descriptive narratives. As observed by Gay (2004), qualitative data provides rich descriptions and explanations that demonstrate the chronological flow of events, and often leads to serendipitous (chance) findings. The researcher finally used results of data analysis to draw explanations, conclusions and recommendations about the study.

3.11 Ethical Considerations

Anonymity of the respondents as well as that of the selected schools was guaranteed by requesting the respondents not to indicate their names and their schools. Care was taken to ensure that administration of the research instruments did not coincide with examination time or other important school activities. The researcher presented the permit to the Sub County Director of Education to be allowed to conduct the study. The consent of the respondents was sought before they were engaged in the study. The respondents involved in the study were assured of confidentiality of the information they gave. The identities of the respondents was treated with confidentiality. Data was used only for the purpose of the study. All work from other researchers is well acknowledged in the list of references

3.12 Operationalization of Variables

Table 3.2: Operationalization of variables

Objective	Type of Variable	Indicators	Measure	Level of scale	Approach of analysis	Type of analysis	Level of analysis
Integration of ICT in teaching and learning	Dependent variable:	Areas of integration	Frequency of integration	ordinal	Quantitative /qualitative	Non parametric	Descriptive
To determine how availability of ICT infrastructure influenced integration of ICT in teaching and learning	Independent variable:	Physical presence of ICT equipment	No of hardware and software available	Ordinal	Qualitative	Non parametric	Descriptive
To determine how technical support influenced integration of ICT in teaching and learning	Independent variable:	Availability of full time ICT technicians	promptness of repairs	Ordinal	Quantitative	Non parametric	Descriptive
To determine how teacher competence in ICT influenced integration of ICT in teaching and learning	Independent variable:	Level of training , ability to use ICT equipment Number of ICT courses attended	Level of training , No of lessons taught using ICT	Ordinal	Quantitative	Non parametric	Descriptive

CHAPTER FOUR

DATA ANALYSIS, INTERPRETATION AND PRESENTATION

4.1 Introduction

This section presents the analysis, presentation, and the interpretation of findings. The data is analyzed around key variables such as competence of teachers in the use and application of computer technology, technical support in the use of computers in teaching and learning of computer studies and availability of ICT infrastructure which influence the integration of ICT in teaching and learning. The findings are presented using mainly descriptive statistics. Themes and summaries from principals' interview guide are included to supplement the information gathered through questionnaires from the students and the teachers. Presented below are key findings of the study.

4.2 Return Rate

Out of 100 questionnaires administered to the students, 100 were responded to and were accepted for analysis representing a return rate of 100.00% which is statistically acceptable. Out of 40 questionnaires administered to the teachers, 40 were responded to and were accepted for analysis representing a return rate of 100.00% which is statistically acceptable. All the four (4) head teachers gave their responses in the interview schedule.

4.3 Background Information

Section one of the teachers' and students' questionnaires sought information on teachers' and students' demographic characteristics. Such information is considered important in providing a better understanding of the respondents thus assisting in the interpretation of results. The researcher sought information on the respondents'

characteristics by establishing their gender, age, educational qualifications and teaching experience.

4.3.1 Gender of the Respondents

The study sought information on the gender of teachers and students who participated in the study. The results are presented in Table 4.1.

Table 4.1: Gender of Respondents

Gender	Teachers		Students	
	Frequency	Percentage	Frequency	Percentage
Male	28	70.00	63	63.00
Female	12	30.00	37	37.00
Total	40	100	100	100

From the findings in Table 4.1, majority of the respondents for both teachers (70.0%) and students (63.0%) were males while female teachers and students comprised of 30.0% and 37.0% respectively. Gender differences may be attributed to proportionate sampling used in the study.

4.3.2 Age of the Students

The study sought information on the age of students who participated in the study.

The results are presented in Table 4.2

Table 4.2: Age of Students

Age	Frequency	Percentage
Below 14 years	1	1.00
14 – 15 Years	3	3.00
16 – 17 Years	44	44.00
18 – 19 Years	48	48.00
Above 19 Years	4	4.00
Total	100	100.0

Findings in Table 4.2 show that majority of the students (92%) were aged between 16 and 19 years of age. There was 1% of the students in the sampled population who were aged below 14 years, 3% were aged 14 -15 years and 4% were aged above 19 years. These findings correspond well with the national figures which show that students in secondary schools are usually aged between 14 and 19 years of age.

4.3.3 Highest Academic Qualifications of the Respondents

The study sought information on the academic qualifications of the teachers. The information generated from this item is presented in Table 4.3.

Table 4.3: Teachers' Education Qualifications

Qualification	Frequency	Percentage
Diploma education without computer	1	2.5
Diploma education with computer	8	20.0
B,ed with computer as teaching or core subject	7	17.5
B,ed without computer as teaching or core subject	22	55.0
Masters	1	2.5
Untrained	1	2.5
Total	40	100.0

The findings in Table 4.3 indicate that 72.5% of the teachers had a bachelor of education degree, 2.5% had a Masters degree while 22.5% had attained a diploma in Education. There was also a minority 2.5% who were untrained teachers. This implies that majority of the teachers who participated in the study had necessary qualifications to enable them deliver their services as teachers. However, very few had additional qualification in computer usage (37.5%). This could have negative effect on the integration of ICT in teaching and learning in secondary schools in Tigania West Sub County.

4.3.4 Teaching Experience of the Teachers

The study sought to establish the teaching experience of the teachers. Table 4.4 presents the findings.

Table 4.4: Teaching Experience of the Teachers

Experience	Frequency	Percentage
Less than 1 Year	2	5.00
1 – 5 Years	19	47.50
6 – 10 Years	17	42.50
Above 10 Years	2	5.00
Total	40	100.00

Table 4.4 shows that majority (52.5%) of the teachers had been in the teaching profession for less than five years. Those who had taught for more than 5 years constituted 42.5%. This finding suggests that many of the teachers had inadequate experience to enable them make a greater impact as far as integration of ICT in teaching and learning was concerned in Tigania West Sub- County.

4.4 Integration of ICT in Teaching and Learning in Public Secondary Schools in Tigania West Sub-County

The growth of the global economy and the information based society has pressured education systems around the world to use technology to teach students the knowledge and skills they need. Integration of ICT provides the tool needed by the information knowledge society. Thus, teachers are inevitably presented with the demand to integrate ICT to empower learners in this digital era. This section provides findings around the extent to which ICT has been integrated in teaching and learning in secondary schools in Tigania West Sub-County.

4.4.1 Utilization of ICT among teachers to achieve professional objectives

Teachers were presented with a list of personal/professional objectives and requested to indicate how often they used ICT to achieve these objectives. Table 4.5 presents the findings.

Table 4.5: Utilization of ICT among teachers to achieve professional objectives

Personal/Professional Objective	Daily		Weekly		At least once per term		Never		WA
	F	%	F	%	F	%	F	%	
Create materials for students use (e.g. handouts, tests)	8	20.0	16	40.0	12	30.0	4	10.0	2.1
Access research and best practices for teaching	4	10.0	13	32.5	18	45.0	5	12.5	2.6
Curriculum administration (e.g. planning, monitoring, evaluating and reporting)	5	12.5	8	20.0	18	45.0	9	22.5	2.8
Communicate with colleagues/other professionals	12	30.0	9	22.5	10	25.0	9	22.5	2.4
Communicate with student(s) and/or students' parent(s)	7	17.5	8	20.0	15	37.5	10	25.0	2.7
Post information to a website to assist your students in their work	3	7.5	7	17.5	8	20.0	22	55.0	3.2
Online professional learning	10	25.0	9	22.5	6	15.0	15	37.5	2.7

Findings in Table 4.5 indicate the extent to which teachers utilized ICT in teaching and learning. According to the Table, teachers used ICT to create materials for students use (e.g. handouts, tests) weekly (WA=2.1), at least once per term, teachers utilized ICT to access research and best practices for teaching (WA=2.6), and at least once in a year teachers utilized ICT in curriculum administration (e.g. planning, monitoring, evaluating and reporting) (WA=2.8). This indicates that utilization of ICT

in teaching and learning was minimal. Further, the results show that teachers used ICT weekly to communicate with colleagues/other professionals (WA=2.4), at least once in term to communicate with student(s) and/or students' parent(s) (WA=2.7), at least once per term to post information to a website to assist students in their work and at least once in term for online professional learning. Teaching and learning happens on a daily basis in secondary schools and since none of the teachers indicated that they used ICT on a daily basis is confirmation that teachers had not fully embraced ICT in teaching and learning in secondary schools in Tigania West Sub – County.

4.4.2 Students' attitude towards learning with computers

Students were requested to say whether they liked learning with computers. Table 4.6 presents the findings.

Table 4.6: Students' attitude towards learning with computers

Response	Frequency	Percentage
Yes	94	94.0
No	6	6.0
Total	100	100

Table 4.6 shows that 94.0% of students covered by the study liked learning with computers while 6% dint. This is an indication that majority of the students had a positive attitude towards integration of ICT in teaching and learning. Other factors held constant, such positive attitude is a potential success factor for integration of ICT in teachings and learning in secondary schools not only in Tigania West Sub County, but also in the entire nation.

The study sought to get information on the reasons why ICT was not used in teaching and the findings are represented in table 4.7.

Table 4.7: Reasons for disliking learning with computer

Reasons	Frequency	Percentage
It's too complicated	3	50
Don't know how to operate	2	33.3
We have very few computers	1	16.7
Total	6	100

As shown in Table 4.7, 50% of students who did not like learning with computers attributed this dislike to the notion that computers were too complicated, those who attributed it to not knowing how to operate computers were 33.3% while those who attributed it to scarcity of computers were 16.7. This makes use of computers in teaching and learning cumbersome. Such issues should be addressed in future for successful implementation or roll out of integration of ICT and learning Kenya.

4.4.3 Students' ability to use computers

The study sought to find to out whether students were able to use computers in learning. The findings are as presented in table 4.8.

Table 4.8: Whether students could use computers

Response	Frequency	Percentage
Yes	29	29.0
No	71	71.0
Total	100	100.0

Findings in Table 4.8 shows that 29.0% of students could competently operate a computer while the majority ,71.0% could not. This indicates that students did not have the required skills to handle computers and this ultimately has a negative impact on the integration of ICT in teaching and learning.

For those who could not operate a computer, they were requested to give some of the reasons as to why they were unable to operate computers. Table 4.9 presents the findings.

Table 4.9: Reasons for students' inability to operate computers

Reasons	Frequency	Percentage
Computers are not enough for all students	20	28.17
Never been taught how to operate computer	24	33.80
Lack of interest	6	8.45
Lack of adequate practice	12	16.90
Fewer computer teachers	9	12.68
Total	71	100

As shown in table 4.9 these are the reasons why students could not operate computers: Lack of enough computers (28.17%) coupled with inadequate computer training and skills (33.80%) consequently resulting into inadequate practice among students (16.90%) were cited as the major reasons for not operating computers competently by students as illustrated in table 4.9. Other reasons given by students include lack of interest and few computer teachers (12.68%). All these are responsible for inability of students to operate computers and consequently will affect integration of ICT in teaching and learning in Tigania West Sub County.

4.4.4 computer application packages that students were proficient in.

Students who initially indicated that they could operate computers were requested to give the application packages they were proficient in ,or they were able to use. Table 4.10 presents the findings.

Table 4.10: Computer application packages that students were proficient in

Application	Frequency	Percentage
Databases or Ms Access	2	6.90
Ms word	10	34.44
Desktop Publishing	1	3.45
Ms PowerPoint	1	3.45
Spread sheets or Ms Excel	7	24.14
Internet and communication	8	27.58
Total	29	100

Table 4.10 shows that 34.44% of students are proficient in MS Word, 27.60% were proficient in internet and communication, 24.14% in Ms Excel, 6.90% were proficient in Ms Access, 3.45% in Desktop Publishing while 3.45% were proficient in Ms PowerPoint. These findings in overall indicate that majority of students in Tigania West Sub County could not proficiently use basic applications in computers. Again this will negatively affect integration of ICT in teaching and learning in the Sub County.

4.4.5 Frequency of students' weekly practice with computers

Students were requested to indicate the number of times in a week they practised with computers. Table 4.11 presents the findings.

Table 4.11 Frequency of students’ weekly practice with computers

Number of times	Frequency	Percentage
Every day	1	1.0
Quite often	25	25.0
Not at all	74	74.0
Total	100	100.0

Findings in Table 4.11 reveal that 1.0% of students practiced on the computer every day, 25.0% practiced on the computer quite often and majority 74.0% did not practice with the computer at all. This is a negative indicator that majority of students did not get to familiarize themselves with computers on a regular basis.

4.4.6 Personal work students are able to do with computers

Students were requested to indicate the kind of personal work they could be able to do with computers. Table 4.12 presents the findings.

Table 4.12: Personal work students are able to do with computers

Personal work	Frequency	Percentage
Accessing information on topics in the syllabuses	5	5.0
Accessing post examination papers	2	2.0
Doing assignments and posting them to the teacher	2	2.0
Sending and receiving emails	9	9.0
I do not do personal studies using a computer	82	82.0
Total	100	100.0

Findings in Table 4.12 show that majority of the students did not use computers for

personal studies (82.0%). Instead for the few who used computers, they used them for nonacademic work including sending and receiving emails (9.0%), others used the computers for accessing information on topics in the syllabuses (5.0%), accessing post examination papers (2.0%) and doing assignments and posting them to the teacher (2.0%). This again will negatively affect integration of ICT in teaching and learning in public secondary schools in Tigania West Sub County.

4.5 Influence of Availability of ICT Infrastructure on Integration of ICT in Teaching and Learning in Public Secondary Schools

Schools need to be equipped with modern ICT gadgets to enable them access internet fast (Omufwoko, 2009). The computers should have latest version and computer packages to enable students perform a variety of tasks. Poor infrastructure remains a major obstacle in many developing states (Howie, Muller & Paterson, 2005). Akunja (2011) observes that lack of adequate ICT infrastructure has hampered provision of efficient and affordable ICT services in the country. This study sought to examine how availability of ICT infrastructure influences integration of I.C.T in teaching and learning in public secondary schools.

4.5.1 Whether the schools had computer laboratories for teaching and learning

Teachers were requested to indicate whether schools had computer laboratories for teaching and learning. Table 4.13 presents the findings.

Table 4.13: Whether the schools had computer laboratories for teaching and learning

Existence of computer labs	Frequency	Percentage
Yes	39	97.5
No	1	2.5
Total	40	100.0

Findings in Table 4.13 indicate that majority of the teachers (97.5%) agreed that their schools had computer laboratories for teaching computer studies. Only a minority of 2.5% of the teachers said that their schools lacked computer laboratories. 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 computers (hardware, software, etc.). Secondary schools in Tigania West Sub County had made an effort to ensure availability of computer laboratories which when equipped with the relevant computers and other relevant ICT facilities could contribute immensely to the integration of ICT in teaching and learning.

4.5.2 Hardware available for teaching and learning

Teachers were requested to indicate or list the hardware that was available in schools which could be used for teaching and learning. Table 4.14 presents the findings.

Table 4.14: Hardware available for teaching and learning

Hardware	Frequency	Percentage
Computers	32	80.0
Projectors	4	10.0
Monitors	4	10.0
Total	40	100.0

Table 4.14 shows that majority of the schools (according to the teachers) had computers (80.0%) which could be used for teaching and learning. Few of the schools had projectors (10.0%) and monitors (10.0%). This indicates that in majority of the schools, ICT resources were accessible to be used for teaching and learning. Access to computers, updated software and other hardware are key elements to successful adoption and integration of technology in teaching and learning.

4.5.3 Connection to the internet

Teachers were requested to indicate whether their schools were connected to the internet. Table 4.15 presents the findings.

Table 4.15: Connection to the internet

Connected to the internet	Frequency	Percentage
Yes	12	30.0
No	28	70.0
Total	40	100.0

Table 4.15 shows that majority of the schools were not connected to the internet (70.0%) which is instrumental in teaching and learning. Few of the schools were connected to the internet (30.0%). Lack of internet connection in most schools could hinder successful adoption and integration of information communication technology in teaching and learning. For the schools that were connected to the internet, the researcher requested the teachers to indicate the mode of connectivity. Table 4.16 presents the findings.

Table 4.16: Mode of connectivity

Mode of connection	Frequency	Percentage
Satellite dish	1	8.33
HDSPA/Modem	2	16.67
Gateway/Access points	6	50.00
WI-FI	3	25.00
Total	12	100.00

Findings in Table 4.16 reveal that among the schools that were connected to the internet, majority (50.00%) were connected to the internet through a gateway or sometimes referred to as access point. Others were connected through Wi-Fi (25.00%). A small percentage (16.67%) and 8.33% were connected to the internet through modems and satellite dish respectively.

4.5.4 Type of application software used in teaching and learning

Teachers were requested to indicate the type of application software they were using in teaching and learning. Table 4.18 presents the findings.

Table 4.17: Type of application software used in teaching and learning

Application software	Frequency	Percentage
Ms Word	14	35
Ms PowerPoint	12	30
Ms Excel	10	25
Ms Access	4	10
Total	40	100

Findings in Table 4.17 summarize some of the application software that were used in teaching and learning. Among these application software were Ms Word (35%), Ms PowerPoint (30.00%), Ms Excel (25%) and Ms Access (10%).

4.5.5 Head teachers' opinion on influence of ICT infrastructure on integration of ICT in teaching and learning

Head teachers were requested to give their opinion on the influence of ICT infrastructure on the integration of ICT in teaching and learning. Table 4.19 presents the findings.

Table 4.18: Head teachers' opinion on influence of ICT infrastructure on integration of ICT in teaching and learning

Opinion	Frequency	Percentage
Few schools have been equipped with adequate ICT infrastructure and this greatly hampers integration of ICT in teaching and learning	1	25.0
Some schools have low teacher to ICT facilities ratio	1	25.0
Some facilities are old and poorly maintained	1	25.0
Few schools have started computer lessons though not all schools due to poor infrastructure	1	25.0
Total	4	100.0

According to the findings in Table 4.18, head teachers in general were of the opinion that there was inadequate ICT infrastructure across Tigania West Sub County which hampered integration of ICT in teaching and learning. One of the head teachers said “Few schools have been equipped with adequate ICT infrastructure and this greatly hampers integration of ICT in teaching and learning”. Another school head said “some schools have low teacher to ICT facilities ratio”. Another school head was of the opinion that some facilities were old and poorly maintained making it difficult to integrate ICT in teaching and learning in secondary schools in Tigania West Sub County. Furthermore, few schools have started computer lessons though not all schools due to poor infrastructure. This is an indication that inadequate ICT infrastructure was negatively affecting the integration of ICT in teaching and learning in secondary schools in Tigania West Sub County.

4.5.6 Availability of equipment and facilities for teaching and leaning

Using up-to-date hardware and software resources is a key feature to diffusion of technology (Gulbahar, 2005). In the developed world, most of the schools are equipped with different kinds of technological infrastructure and electronic resources are available. For instance one Australian school had provided personal notebook computers and had their own web spaces, email access and workspace for all staff, and students from Year 5 onwards (Gulbahar, 2005). Video conferencing was available and the school had established its own intranet, placing all its resources on-line. These were accessible via radio connections from school and home. Through an observation checklist, the researcher sought to determine the availability of teaching and learning equipment and ICT facilities essential in teaching and learning in secondary schools in Tigania West Sub County. Table 4.20 presents the findings.

Table 4.19: Availability of equipment and facilities for teaching and learning

Equipment/facilities	Available		Not available	
	F	%	F	%
Internet	3	75.00	1	25.00
Printers	4	100.00	0	0.00
Laptops	4	100.00	0	0.00
Simulation Software	0	0.00	4	100.00
Storage Devices	4	100.00	0	0.00
Scanner	4	100.00	0	0.00
Photograph/ slides	4	100.00	0	0.00
Videos	4	100.00	0	0.00
Journals/Newspaper	4	100.00	0	0.00
Books	4	100.00	0	0.00
Realia	4	100.00	0	0.00
Desktop computers	4	100.00	0	0.00
Fans	3	75.00	1	25.00
White board	3	75.00	1	25.00
Hub	1	25.00	3	75.00
Furniture	4	100.00	0	0.00
Electrical fuse	4	100.00	0	0.00
Anti-Virus Software	4	100.00	0	0.00
Connection cables	4	100.00	0	0.00
Technician	1	25.00	3	75.00
First Aid Kit	3	75.00	1	25.00
Laboratory	4	100.00	0	0.00

Findings in Table 4.19 reveal that most schools had the basic equipment and facilities to ensure teaching and learning went on smoothly. In relation to ICT, all schools did not have simulation software (100.00%), they lacked a technician (75.00%), the

lacked a hub (75.00%) which is essential for networking purposes. However other equipment and facilities like desktop computers, antivirus software, connection cables, computer laboratory, scanners, furniture, storage devices, and printers among others were all available. Availability of such equipment and facilities ensures teaching and learning takes place and offers potential for integration of ICT in teaching and learning.

4.6 Influence of Technical Support on Integration of ICT in Teaching and Learning in Public Secondary Schools

The breakdown of a computer causes interruptions and if there is lack of technical assistance, then it is likely that the regular repairs of the computer will not be carried out resulting in teachers not using computers in teaching. According to Becta (2004), if there is a lack of technical support available in a school, then it is likely that technical maintenance will not be carried out regularly, resulting in a higher risk of technical breakdowns. This study therefore sought to determine how technical support influences integration of ICT in teaching and learning in public secondary schools.

4.6.1 Whether schools had a computer technician

Teachers were requested to indicate whether their schools had a computer technician.

Table 4.20 presents the results

Table 4.20: Whether schools had a computer technician

Response	Frequency	Percentage
Yes	18	45.0
No	22	55.0
Total	40	100.0

According to the teachers who participated in the study, most schools (55.0%) had no computer technician. ICT support in schools influence teachers to apply ICT in classrooms without wasting time troubleshooting hardware and software problems. Lack of technical support for the teachers therefore may be a hindrance to integration of ICT in teaching and learning. This finding is similar to findings of a study done by Tong and Trinidad (2005) who established that if there is no technical support for teachers, they become frustrated resulting in their unwillingness to use ICT.

4.6.2 Role of the computer technician

Teachers who indicated that their schools had a technician were requested to give the role of the computer technician in their school. Table 4.22 presents the results.

Table 4.21: Role of computer technician

Role of the computer technician	Frequency	Percentage
Assisting students and teachers on use of computers	1	5.56
Ensure all computers are working effectively	2	11.11
Ensure the computer lab and machines are orderly	2	11.11
Instructing, supervising students during practical lessons	1	5.56
Maintenance and guidance on how to use computers	4	22.22
Preparation and maintenance of computers in school	2	11.11
Teaching where possible	6	33.33
Total	18	100

Findings in Table 4.21 summarizes some of the role of a computer technician in secondary schools in Tigania West Sub County as put by the teachers. Among the roles were: Assisting students and teachers on use of computers (5.55%), ensuring that all computers are working effectively (11.11%), ensuring that the computer lab and machines are orderly (11.11%), instructing, supervising students during practical lessons (5.55%), maintenance and guidance on how to use computers (22.22%), preparation and maintenance of computers in school (11.11%) and teaching where possible (33.33%). From these findings, it must be appreciated that appreciated technical support to help teachers to integrate technology into their teaching is crucial and therefore schools must be provided with the necessary technical support with regard to repair and maintenance for the continued use of ICT in schools.

4.6.3 Person that maintains the ICT equipment in school

Teachers were requested to indicate the person who was responsible for the maintenance of the ICT equipment in their school. Table 4.23 presents the results.

Table 4.22: Person that maintains the ICT equipment in school

Person	Frequency	Percentage
School's own staff	24	60.0
An external company contracted by the school	12	30.0
An external unit arranged by educational authorities	4	10.0
Total	40	100.0

Findings in Table 4.22 indicates that in majority of the schools (60%), maintenance of the school ICT was done by the schools' own staff while in a few schools it was either done by an external company contracted by the school (30%) or by an external unit arranged by educational authorities (10%). Easy access or availability of technical support and maintenance should be made an important element of the school ICT environment so as to maintain hardware and infrastructure.

4.6.4 Support provided by different service providers

Teachers were requested to indicate the type of support that different service providers provided to the teachers when they used ICT in teaching and learning in their schools. Table 4.23 presents the findings.

Table 4.23: Support provided by different service providers

Service provider	Rarely/never used		Mostly technical support		Mostly pedagogical support		Both technical and pedagogical support		WA
	F	%	F	%	F	%	F	%	
A more experienced / knowledgeable teacher	12	30.00	4	10.00	6	15.00	18	45.00	1.75
School ICT/technology coordinator	15	37.50	15	37.50	3	7.50	7	17.50	2.05
Other school staff	14	35.00	10	25.00	6	15.00	10	25.00	2.30
Experts from outside the school	18	45.00	6	15.00	6	15.00	10	25.00	2.20
An online helpdesk, community or website	15	37.50	9	22.50	2	5.00	14	35.00	2.38

According to Table 4.23 majority of the teachers were in agreement that a more experienced teacher or a more knowledgeable teacher offered mostly pedagogical support (WA=2.75), school ICT/Technology coordinator mostly offered technical support (WA=2.05). Additionally majority of the teachers were of the opinion that other school staff offered mostly technical support (WA=2.30), experts from outside the school also offered mostly technical support (WA=2.20) and that an online help desk, community or website offered mostly technical support (WA=2.38).

4.6.5 Whether technician responds promptly in case of a problem

Teachers were requested to indicate whether the computer technician responded promptly in case a problem occurred with the computers or any of the ICT infrastructures. Table 4.24 presents the findings.

Table 4.24: Whether technician responds promptly in case of a problem

Response	Frequency	Percentage
Strongly Agree	13	32.50
Agree	21	52.50
Neither Agree Nor Disagree	4	10.00
Disagree	2	5.00
Total	40	100.00

According to Table 4.24, majority (85.00%) of the teachers agreed that the computer technician responded promptly in case a problem occurred with the computers or any of the ICT infrastructures. This implies that most schools had dedicated computer technicians who handled computer problems swiftly. Prompt access or availability of technical support is an important feature of the school ICT environment so as to maintain ICT Infrastructure.

4.6.6 Head teachers' opinion on influence of Technical support on integration of ICT in teaching and learning

Head teachers were requested to give their opinion on the influence of technical support on the integration of ICT in teaching and learning. Table 4.25 presents the findings.

Table 4.25: Head teachers’ opinion on influence of technical support on integration of ICT in teaching and learning

Opinion	Frequency	Percentage
Few trainers of trainers in the sub county and ICT champions,	1	25.0
Inadequate resources to carry out ICT Training	1	25.0
Inadequate trained or skilled personnel to ensure integration	1	25.0
There is shortage of technical support	1	25.0
Government and individual schools' initiative has begun bringing hope in ICT learning integration	2	50.0
The right instructions will lead to integration	1	25.0

According to the findings in Table 4.25, head teachers in general opined that there was inadequate technical support across Tigania West Sub County which hampered integration of ICT in teaching and learning. One of the head teachers said “there is inadequate trained or skilled personnel to ensure integration and this greatly hampers integration of ICT in teaching and learning”. Another school head said “some schools have inadequate resources to carry out ICT training”. This is an indication that inadequate technical support was negatively affecting the integration of ICT in teaching and learning in secondary schools in Tigania West Sub County.

4.7 Influence of Teacher Competence in ICT on Integration of ICT in Teaching and Learning in Public Secondary Schools.

Teacher competence is related to the ability of the teacher to handle a wide range of varying computer applications for various purposes (Vannatta. & Fordham, 2004) and

according to Bordbar (2010), it is a major predictor of integrating ICT in teaching and learning. This study sought to determine how teacher competence in ICT influenced integration of ICT in teaching and learning in public secondary schools. This section therefore provides findings on the influence of teacher competence in ICT on integration of ICT in teaching and learning in public secondary schools in Tigania West Sub County.

4.7.1 Attendance of courses in computer studies

Teachers were required to indicate whether they had attended any trainings or refresher courses in computer studies. The results are shown in table 4.26.

Table 4.26: Attendance of courses in computer studies

Attendance of computer courses	Frequency	Percentage
Yes	17	42.5
No	23	57.5
Total	40	100.0

According to Table 4.26, majority (57.50%) of the teachers had not attended any training or refresher courses in computer studies. Refresher courses are part of professional development for teachers and are crucial for any successful technology adoption and education programs. Baylor and Ritchie (2002) carried out a quantitative study that looked at the factors facilitating teacher skill, teacher morale, and perceived student learning in technology-using classrooms. They found that professional development had a significant influence on how well ICT was embraced in the classroom. They also found that teachers' training programmes often focus more on

basic literacy skills and less on the integrated use of ICT in teaching. Findings from this study reveal that few teachers were involved in professional development activities related to computer studies and hence this could hamper integration of ICT in teaching and learning in secondary schools in Tigania West Sub County.

When asked to elaborate on the way in which the training in computer studies addressed the integration of ICT in teaching and learning, teachers were of the opinion that teachers' training programmes often focus more on basic literacy skills and less on the integrated use of ICT in teaching. Despite the government policy on use of ICT in schools, teachers have received little training in this area in their teacher education programs. According to Schaffer and Richardson (2004), when technology is introduced into teacher education programs, the emphasis is often on teaching about technology instead of teaching with technology. Hence, inadequate preparation to use technology is one of the reasons that teachers do not systematically use computers in their classes.

4.7.2 Degree of adequacy to which college media and instructional courses prepared teachers for use of ICT in teaching and learning in secondary schools

Teachers were required to indicate the extent to which college media and instructional courses prepared teachers for use of ICT in teaching and learning in secondary schools. The results are shown in table 4.27.

Table 4.27: Degree of adequacy to which college media and instructional courses prepared teachers for use of ICT in teaching and learning

Degree of adequacy	Frequency	Percentage
None at all	8	20.0
Little	13	32.5
Some	12	30.0
A Lot	7	17.5
Total	40	100.0

According to Table 4.27, university or college training did little (32.5%) or nothing at all (20.0%) in preparing teacher trainees for use of ICT in teaching and learning in secondary schools. This finding is similar to findings of Peralta and Costa (2007) who established that teachers competence influence integration of ICT in teaching and learning. It also agrees with Kidombo and Gakuu(2012) who also found that the competence of the school principal in the use of ICT and a broad understanding of technical, curricular. administrative ,financial and social dimensions of ICT use in education as important to the effectiveness and sustainability of ICT integration programmes.

4.7.3 Ability of the teachers to troubleshoot computer related issues

Teachers were required to indicate their capability in trouble shooting computer related issues when they arose. The results are shown in table 4.28.

Table 4.28: Ability of the teachers to troubleshoot computer related issues

Response	Frequency	Percentage
Yes	16	40.0
No	24	60.0
Total	40	100.0

According to Table 4.28, majority of the teachers had limited capability to troubleshoot computer related issues then they occurred. This raises questions on their competence in the area of computers which ultimately affect integration of ICT in teaching and learning. This confirmed by Pelgrum (2001) who observed that the success of educational innovations depends largely on the skills and knowledge of teachers. Also, he found that teachers' lack of knowledge and skills was the second most inhibiting obstacle to the use of computers in schools.

4.7.4: Areas teachers could handle in case of troubleshooting

The study sought to find out the areas the teachers could handle in case of trouble shooting. The findings are as presented in table 4.29

Table 4.29: Areas teachers could handle in case of troubleshooting

Area	Frequency	Percentage
Network	1	6.25
MS Word	2	12.5
Booting	3	18.75
Power supply	1	6.25
Excel,	3	18.75
Publisher	3	18.75
Access	3	18.75
Total	16	100

Among the area teachers could trouble shoot were networks (6.25%), MS word

(12.5%), booting of the computer (18.75%), power supply (6.25), excel (18.75), publisher (18.75) and access (18.75) as shown in Table 4.29

4.8 Regression Analysis

A logistic regression analysis was conducted to predict the relationship between factors influencing integration of ICT and integration of ICT. The predictors included ICT infrastructure, technical support and teacher competence. A test of the full model against a constant only model was statistically significant, indicating that the predictors as a set reliably distinguished between integration of ICT and lack of integration of ICT in teaching and learning (chi square 22.399, $p=0.015$ with $df=3$) as shown in table 4.30

Table 4.30: Omnibus tests of model coefficients

		Chi-square	Df	Sig.
Step 1	Step	22.399	3	.015
	Block	22.399	3	.015
	Model	22.399	3	.015

Nagelkerke's R^2 of 0.723 indicated a moderately strong relationship between predictions and grouping. Prediction success overall was 90.0% (92.9% for integration of ICT and 87.5% for lack of ICT integration). The Wald criterion demonstrated that ICT infrastructure, technical support and teacher competence all contributed to prediction of ICT integration ($p=0.011$, $p=0.022$, $p=0.013$ respectively) since it was below 0.05 as shown in table 4.31. Thus all the factors considered were statistically significant predictors of ICT integration.

Table 4. 31 Variable in the equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1(a)	ICT infrastructure	2.386	.605	7.406	1	.011	10.001
	technical support	1.780	1.462	5.284	1	.022	9.459
	teacher competence	12.402	8.129	4.338	1	.013	11.045

The EXP(B) value indicates that when ICT infrastructure was raised by one unit the odds ratio is 10 times as large and therefore ICT infrastructure is 10 more times likely to increase integration of ICT. The EXP(B) value also indicates that when

technical support is raised by one unit the odds ratio is 9 times as large and therefore technical support is 9 more times likely to increase integration of ICT. On the other hand, the EXP(B) value indicates that when teacher competence is raised by one unit the odds ratio is 11 times as large and therefore teacher competence is 11 more times likely to increase integration of ICT.

Thus from the regression analysis, ICT infrastructure was the most significant factor affecting integration of ICT, followed by teacher competence and finally the technical support as indicated by the p value of 0.011, 0.013 and 0.022

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents a summary of the main study findings, conclusions and recommendations. The chapter also covers recommendations of the study as well as suggestions for further research. The main purpose of this study was to examine the factors influencing integration of ICT as a teaching and learning tool in public secondary schools in Tigania West Sub County. Specifically the study sought to examine how availability of ICT infrastructure influenced integration of I.C.T in teaching and learning in public secondary schools, determine how technical support influenced integration of ICT in teaching and learning in public secondary schools and determine how teacher competence in ICT influenced integration of ICT in teaching and learning in public secondary schools.

5.2 Summary of Main Findings

Study findings revealed that teachers used ICT to create materials for students use (e.g. handouts, tests) weekly (WA=2.3), at least once per term, teachers utilized ICT to access research and best practices for teaching (WA=2.6), and at least once in a year teachers utilized ICT in curriculum administration (e.g. planning, monitoring, evaluating and reporting) (WA=2.8) an indication that utilization of ICT in teaching and learning was minimal. Teaching and learning happens on a daily basis in secondary schools and since none of the teachers indicated that they used ICT on a daily basis is confirmation that teachers had not fully embraced ICT in teaching and learning in secondary schools in Tigania West Sub – County.

Study results showed that majority of the students covered by the study liked learning with computers an indication that students had a positive attitude towards integration of ICT in teaching and learning. Even though they liked learning with computers, only a handful (29.0%) could competently operate a computer with ease implying that students did not have the required skills to handle computers and this would ultimately have a negative impact on the integration of ICT in teaching and learning.

For those who could not operate a computer, they were requested to give some of the reasons as to why they were unable to operate computers. Table 4.10 presents the findings. Reasons for inability to operate computers among learners included: lack of enough computers (28.17%), inadequate computer training and skills (83.10%), inadequate practice among students (16.90%), lack of interest and few computer teachers (12.68%).

Study findings further revealed that majority of the students did not use computers for personal studies (82.0%). For the few who used computers, they used them for nonacademic work including sending and receiving emails which again confirmed minimal integration of ICT in teaching and learning in public secondary schools in Tigania West Sub County.

In relation to availability of infrastructure, study findings revealed that majority of the teachers (97.5%) agreed that their schools had computer laboratories for teaching computer studies. In addition, majority of the schools (according to the teachers) had computers (80.0%) which could be used for teaching and learning an indication that in majority of the schools, ICT resources were accessible to be used for teaching and

learning.

The study also established that majority of the schools (70%) were not connected to the internet and this could hinder successful adoption and integration of information and communication technology in teaching and learning. Findings revealed that among the schools that were connected to the internet, majority (50.00%) were connected to the internet through a gateway or sometimes referred to as access point. Others were connected through Wi-Fi (25.00%). A small percentage (16.67%) and 8.33% were connected to the internet through modems and satellite dish respectively. Head teachers in general were of the opinion that there was inadequate ICT infrastructure across Tigania West Sub County which hampered integration of ICT in teaching and learning. This is in agreement with Kidombo (2012) who found availability and access to ICT infrastructure as a factor influencing ICT integration in teaching.

In relation to technical support, most schools (55.0%) had no computer technician. Lack of technical support for the teachers therefore may be a hindrance to integration of ICT in teaching and learning. In majority of the schools (60%), maintenance of the school ICT was done by the schools' own staff while in a few schools it was either done by an external company contracted by the school (30%) or by an external unit arranged by educational authorities (10%). Among the few schools that had technicians, majority (85.00%) of the teachers agreed that the computer technician responded promptly in case a problem occurred with the computers or any of the ICT infrastructure. Head teachers in general were of the opinion that there was inadequate technical support across Tigania West Sub County which hampered integration of ICT in teaching and learning. This is in agreement with the findings by Kidombo

(2012) where technical support was at 50% and hampered ICT integration in teaching.

In relation to teacher competence, majority (57.50%) of the teachers had not attended training or rather refresher courses in computer studies. Refresher courses is part of professional development of teachers and this sits at the heart of any successful technology and education program. Findings from this study revealed that few teachers were involved in professional development activities related to computer studies and hence this could hamper integration of ICT in teaching and training in secondary schools in Tigania West Sub County. When asked to elaborate on the way in which the training in computer studies addressed the integration of ICT in teaching and learning, teachers were of the opinion that teachers' training programmes often focused more on basic literacy skills and less on the integrated use of ICT in teaching. Majority of the teachers had limited capability to troubleshoot computer related issues when they occurred. This negatively affected use of ICT as a teaching and learning tool. It agrees with Bardbar (2010) who urges that lack of ICT skills develops negatives attitudes among teachers in relation to ICT integration in teaching and learning .It also agrees with Peralta and costa (2007) who found lack of technical and pedagogical competences to negatively impact on ICT integration in teaching and learning.

5.3 Conclusions

The rise of ICT has complicated its adoption and integration by teachers in classroom teaching. The effective integration of technology into classroom practices poses a challenge to teachers more than connecting computers to a network. For successful integration of ICT into teaching, this study has highlighted on factors that influence

teachers' use of ICT in teaching and learning. These are personal factors related to teacher competencies in ICT, institutional factors related to ICT infrastructure and technological factors. On teacher competency, this study revealed that teacher's training, knowledge and skills in ICT influence their use of ICT in teaching and learning. Teachers' professional development is a key factor to successful integration of computers into classroom teaching. In relation to ICT infrastructure, absence of ICT infrastructure; old or poorly maintained hardware; lack of suitable educational software; limited access to ICT ,lack of or unreliable internet connectivity were found to be hindering integration of ICT in teaching and learning in secondary schools in Tigania West Sub County. In regard to technical support, this study established that most schools had no computer technician and that there was inadequate technical support across Tigania West Sub County which hampered integration of ICT in teaching and learning.

From the statistical relationship established,

5.4 Recommendations

On the basis of the findings obtained from the study, the following recommendations are made:

- 1) Secondary schools should develop strategies to identify strengths and weakness of various technological resources with a view to adopting ICT in the process of teaching and learning.
- 2) Secondary schools should source for partners, well-wishers, stakeholders and sponsors to finance the acquisition of more ICT infrastructure. This will ensure the adequacy of computers in the schools so as to improve their use in the process of teaching and learning.

- 3) Schools should lessen the workload of teachers so as to enable them find time to learn and integrate ICT in the process of teaching and learning. Adoption of ICT in the process of teaching and learning would also go a long way in ensuring that the workload of teachers is lessened.
- 4) Secondary schools in Tigania West Sub County should provide teachers with regular trainings and seminars on how to adopt ICT in the teaching and learning process. The schools should ensure that they undergo refresher training on regular basis.
- 5) Secondary schools should adopt policies that guide structured integration of ICT in the process of teaching and learning. One of the policies that can be adopted is adoption of appraisal practices that reward teachers who endeavour to use ICT in the teaching and learning process in addition to outlining ICT competency standards for the teacher trainers.

5.5 Areas of Further Research

Further comparative research is needed to evaluate the cost-effectiveness of integration of ICT in teaching and learning. Further research can be conducted in other sub counties countrywide. In addition further in-depth research could be conducted in a specific area in ICT for instance use of the internet.

REFERENCES

- Afe J.O (2002): Reflections on becoming a teacher and the challenges of teacher education. Paper presented at the inaugural lecture series 64 of the University of Benin
- Afshari, M., Bakar, K.A., Luan, W.S., Samah, B.A., & Fooki, F. S.(2009). Factors affecting teachers' use of Information and Communication Technology. *International Journal of Instruction*, vol. 2, no. 1, pp.78-98
- Aghaunor, L., & Fotoh, X. (2006). Factors Affecting Ecommerce adoption in Nigerian Banks. *Jonkoping International Business School*. Jonkoping University.
- Akunja, M., (2011). Factors Determining ICT Integration in Teaching and Learning in Secondary Schools in Kisumu City: A Case of Kisumu East District, Kisumu, Kenya.
- Alam, S. S., & Noor, M. K. (2006). ICT Adoption in Small and Medium Enterprises: an Empirical Evidence of Service Sectors in Malaysia. *International Journal of Business and Management*, 2(4), 112-125.
- Alam. S., Khatibi, A., Ahmad, M., & Ishmail, H (2007). Factors affecting E-commerce adoption in the Electronic Manufacturing Companies in Malaysia. *International Journal of Commerce and Management*, 17(1/ 2), 125-139
- Albirini, A. (2006). Teachers' Attitudes Toward Information and Communication Technologies. *Journal of Computer & Education*, 47, 373-398.
- Askin, A. (2003). Computer Technology Awareness by Elementary School Teachers. A Case in City Schools. Columbia University.
- Baek, Y.G., Jong, J., & Kim, B. (2008). What makes teachers use of technology in the classroom? Exploring the factors affecting facilitation of technology with a Korean sample *Computers and Education*, vol.50, no. 8, pp. 224-234.
- Bauer, J., & Kenton, J. (2005). Toward technology integration in the schools: Why it isn't happening. *Journal of Technology and Teacher Education*, vol. 13, no. 4, pp. 519-546.

- Baylor , A.L & Richie, d. (2002) What factors facilitate teacher skill, teacher morale and perceived student learning in teaching using classrooms? *Computers and education* 39, 395-414
- Baylor, A. L., & Ritchie, D. (2002). What factors facilitate teacher skill, teacher morale, and perceived student learning in technology using classrooms?. *Computers & Education* 39, 395–414.
- Becta (2003). Primary School ICT and Standards. Canada International Development Research Centre www.becta.org.uk
- Becta. (2004). A review of the research literature on barriers to the uptake of ICT by teachers. Retrieved June 10, 2015, from http://partners.becta.org.uk/page_documents/research/barriers.pdf.
- Belta (2004): a review of research literature on barriers to the uptake of ICT by teachers. Retrieved June 2015 from <http://partners.Becta.org.uk/pagedocuments/researchbarriers.pdf>
- Berner, J. E. (2003). A Study of Factors That May Influence Faculty in Selected Schools of Education in the Commonwealth of Virginia to Adopt Computers in the Classroom.(Abstract Doctoral Dissertation, George Mason University, 2003). ProQuest Digital Dissertations (UMI No. AAT 3090718).
- Bordbar, F (2010) English teachers attitudes towards computer –assisted languages learning. *international journal of language studies* vol 4 no 3 pp27-54
- Bordbar, F. (2010). English teachers’ attitudes toward computer-assisted language learning. *International Journal of Language Studies*, vol. 4, no. 3, pp. 27-54
- Braun, P. (2004). Regional Tourism Networks: The Nexus between ICT Diffusion and Change in Australia. *Information Technology & Tourism*, Vol. 6
- Buabeng Andoh, Charles (2012). Factors influencing teachers adoption and integration of information and communication technology into teaching: A review of literature in the *international journal of education and development using information communication technology (IJEDICT)*, 2012, Vol8, issue 1 pp 136-155-pentecost university Ghana
- Chere masopha, J.C & Bennet, S. (2007): using teacher professional identity to understand classroom ICT practices. *The international journal of learning*, 14(7), 75-82

- Christersten R& Knezek G. (2006): Pathway for preparing tomorrows teacher to infuse technology .computers in schools, Vol 23, no3/4pp1-21
- Cole M (1995) social cultural –historical psychology: some general remarks and a proposal for a new kind of cultural genetic methodology . in J.V westssch P.Drfo,&A Alvarez(Eds), social cultural studies of mind(pp187-214)Newyork; Cambridge university press
- Cuckle, P. &Clarke S. (2002): mentoring student teachers in schools: views, practices and access to ICT. Journal of computer assisted learning 18(3), 330 -340.doi: 1046/j0266-4909.2002.00244.x
- Davis, N., C. Preston, and I. Sahin. (2009). ICT teacher training: Evidence for multinivel evaluation from a national initiative. British Journal of Educational Technology 40, no. 1: 135–48.
- Dementriadis, etal (2003): culture in negotiation: teachers acceptance/resistance attitudes considering the infusion of technology into schools .computers and education 41,19-37
- Dexter, S., & Riedel, E. (2003). Why improving preservice teacher educational technology preparation must go beyond college’s walls. Journal of Teacher Education, vol.54, no. 4, pp. 334–346.
- Drent M. & Meelissen M.(2008): which factors obstruct or stimulate teachers educators to use ICT innovatively? Computers &education Vol 51no 1pp 1’87-199
- Earle R.S(2002): The integration of the institutional technology into public education : promises and challenges . ET magazine , vol 42 no. 1pp5-13
- Emperica (2006): benchmarking access and use of ICT in European schools : final report from head teacher and classroom teacher surveys in 27 European countries . Retrieved 15 August 2008 from <http://ec.europa .ell/information society eeurope;/2010/docs/studies/final report3.pdf>
- Farell G. (2007): ICT education in Kenya . Available online at www.infoder.org.
- Fisser, P. (2001). Using Information and Communication Technology. PhD Thesis, Netherlands: University of Twente
- Frank, K.A, Zhao, Y., & Barma, K. (2004). Social capital and the diffusion of innovations within organizations. The case of computer technology within schools. Sociology of education 77(April) 148-171

- Fullan M. (1993): *changing forces , probing the depths of educational reform ,* London.falmer press.
- Fullan M. (2007): *the new meaning of educational change* New York. Teachers college press
- Garhjdoh , A. & Weller H.G (2005): *A year in the life : two seventh grade teachers implement one to one computing . Journal of research on technology in education, 37(4), 361-375*
- Gay, L. R. (1992). *Educational research.* New York, NY: Maxwell Macmillan International
- Gemino, A., MacKay, N., & Reich, B. (2006). *Executive Decisions about Website Adoption in Small and Medium-Sized Enterprises. Journal of IT Management, Volume 17(1).*
- Gikonyo (2012). *Factors influencing university managers participation in distance education: A case of public universities in Kenya , (unpublished PhD thesis , university of Nairobi)*
- Goktas,Y,Yildrim, S. & Yildrim, Z. (2009) *main barriers and possible enablers of ICTS intergration into pre-service teacher education programs . Turkey Atatirk university (department of computer education and instructional technology)*
- Government of Kenya (2007). *Kenya Vision 2030.* Nairobi: Government Printers
- Granger, C.A & Marbey, M.L(2002):*factors contributing to teachers successful implementation of IT. Journal of computer assisted learning , 18,480-488*
- Gülbahar, Y. (2005). *Technology Planning: A Roadmap to Successful Technology Integration in Schools. Journal of Computers & Education.*
- Gülbahar, Y. (2007). *Technology planning: A roadmap to successful technology integration in schools. Computers & Education, vol. 49, no. 4, pp. 943-956.*
- Hennessy, S.& Deaney, R. (2004): *sustainability and evolution of ICT -supported classroom practices .London UK : British Education and communication s and technology agency*
- Hennessy, Sara et al (2010) *teacher factors influencing classroom use of ICT in sub-Saharan Africa. University of Cambridge . United States*

- Howie, S.J, Muller, A. & Paterson, A. (2005). Information Communication Technologies in South African Secondary Schools. Cape Town: Sites (HRSC Press).
- ICEL (2001) Generic ICT profiles: future skills for tomorrow's world Brussels Belgium: international cooperation Europe ltd. Commission of the European communities, education digest 459344 <http://www2.training.village.gr/download/publication/panorama/2705-enpdf> accessed on 30th may 2015
- Inan J.A &Lowther, D.L. (2010): factors affecting technology integration in k-12 classrooms: a path model .educational technology research and development, 58, 137-154
- Isaacs, S (2007): ICT in education in South Africa, retrieved from [http: independent.academia.edu/ shafika Isaacs/papers/825521/ICT in education in south Africa](http://independent.academia.edu/shafikaIsaacs/papers/825521/ICT_in_education_in_south_Africa).
- Jay L.Y Nair S.& Lim C.P (2010): supporting one to one computer mediated learning environment in a Singapore primary school.IN l.y Jay, C.P. Lim,&S.K Myint (Eds), a school journey into the future : research by practitioners for practitioners (pp39-67). Singapore: Pearson
- Johnson, M., Calvert, E., & Raggert, N. (2009). ICT in schools Final report. Retrieved June 12, 2015 from http://www.2020.org.nz/template/ict_09_-_online_final_.pdf.
- Jomel L. (2005): teachers' perception about the barriers and catalyst for effective practices with ICT in primary schools. In A tatal and A Jones (Ed) Education and technology for a better world : 9th IFIP TC 3 world conference on computers in education, WCCE29 Bento cancallues , Brazil , July 27-31,29/ proceedings (pp445-453) New York, NY: Springer
- Jonassen, D.H., & Reeves, T.C. (1996). Learning with Technology: Using Computers as Cognitive Tools. In D.H Jonassen (Ed.), Handbook of research for educational communication and technology (pp. 693-719). New York.: Simon and Schuster.
- Jones, A. (2004). A Review of the Research Literature on Barriers to the Uptake of ICT by Teachers. British Educational Communications and Technology Agency. Retrieved May 20, 2015 from <http://www.becta.org.uk>.

- Karsenti T., Collins S., Harper, Gakuu, C.M., Barry, A., & Hafkin, N., (2011). Pedagogical intergration of ICT: Success and challenges from 87African countries. Ottawa, ON:IDRC
- Kathuri, J.N., & Pals, D.A. (1993). Introduction to Educational Research. Njoro: Egerton University Press
- Keiyoro P.N (2013): An analysis of the realationship between acquisition of ICT skills and teaching science curriculum in Nepade schools in Kenya. In the press publication in the journal of open, continuing and distance education volume 2 (issue 1): pp151 -174
- Kenya ICT Landscape (2013). Retrieved on 8th of June 2015 from <http://www.thecud.org/2030701-archive>
- Kidombo, H.J., Gakuu C.M and NdIritu, A. (2012): institutional management and intergration of information and communication technology in teaching and learning in selected Kenyan schools . In the journal of open, continuing and distance education, volume 2 (issue 1): 151-174
- Korte, W.B., & Husing, T. (2007). Benchmarking access and use of ICT in European schools 2006: Results from Head teacher and a classroom surveys in 27 European countries, elearning papers, vol. 29, no. 10, pp. 1-6.
- Kothari, C. (2004). Quantative techniques: 2nd Edition New Delhi: Hindustan Printers
- Kothari, C.R (2007): Research methodology; methods and techniques .K.K Gupta (for new age international cp , Ltd. New Delhi.
- Laronde G. (2010): a study of the information and communication technology intergration by faculty teaching in a ubiquitous laptop bachelor of education programme . university of Toronto . Ontario institute for studies in education (a PHD thesis)
- Lee, M (2010)explaining and predicting users continuance intention towards e-learning : an extension of the expectation –confirmation model . computers and education, 54(2),506-516.
- Leidner, D.E., & Jarvenpaa, S. L. (1995). The use of Information Technology to enhance management school education. A theoretical view. MIS Quarterly, pp. 265-291.

- Lim, Cher Ping (2013). Effective integration of ICT in Singapore schools: pedagogical and policy implications. Association for educational communication and technology. Edith Cowan University, Australia
- Lim, Slewklaw, Taylee Yong & Lim Cher Piny (2011): A discussion of the factors affecting the implementation of one to one computing environment in a primary school. West poing Harbor & Tasmania, Australia
- Lokesh, K. (2004), "Methodology of Educational Research", Vikash Publishing House Pvt. Ltd., New Delhi, p-432.
- London, K. (2006). E-business Adoption in the Construction Industry. Queensland University of Technology
- Louis K.S (2006): organizing for school change. London .Routledge
- Lowa department of education (1989): A guide to developing higher order thinking across the curriculum. des moines IA in the ERCC Document reproduction no E.D 306550
- Marijan Kelentric (2013): Integration of ICT into initial education of classroom teachers: The case of two regions in Croatia. Faculty of education sciences, university of OSLO
- Martin, K. & Acuna, C. (2002). SPSS for Institutional Researchers. Bucknell Lewisburg, Pennsylvania: University Press. 49
- Meelissen MR.M & D rent m. (2008) Gender differences in computer attitudes. Does the schools matter? Computers in human behavior, 24(3), 969-985
- Ministry of education (2014) session paper number 12 of 2014. Nairobi . government printers
- Mugenda, O. (2003): Research methods , qualitative and quantitative approaches. Nairobi acts press
- Mumtaz, S. (2000). Factors Affecting Teachers' Use of Information and Communications Technology: A review of the Literature. Journal of Information Technology for Teacher Education, 9(3), 319-342
- Muriira, L.M .(2013): The challenges and potentials of the class one laptop project in the journal One Laptop per Child Project. Retrieved August 26 2013 from <http://laptop.org/en/laptop/vision2030projects>

- Na, S. I. (1993). Variables associated with attitudes of teachers toward computers in Korean vocational agricultural high schools. Unpublished Doctoral Dissertation. The Ohio State University. AAT 9325563.
- National center for educational statistics (2006) internet access in U.S public school and classroom 1994-2005 <http://inco.ed.gw/pubs2007/2002020pdf>. accessed 15 July 2008
- Newhouse P. (2002): the impact of ICT on learning and teaching .Perth,Western Australia. Department of education
- Norton, S., McRobbie, C., & Cooper, T. (2000). Exploring secondary mathematics teachers' reasons for not using computers in their teaching: Five case studies. *Journal of Research on Computing in Education*, vol. 33, no. 1, pp. 87–109.
- Nut, J. (2010). Professional educators and the evolving role of ICT in schools: Perspective report. Retrieved June 12, 2015 from <http://www.ictliteracy.info/rf.pdf/ICTinSchools.pdf>.
- Nyambane, O & Nzuki Patrick (2014): factors influencing ICT integrating in teaching –a literature review posted in the international journal of education research Vol 2 No 3 of March 2014
- Obijifor L. (2009): mapping theoretical and practical issues in the relationship between ICTS Africa's socio-economic development telematics and informatics, 17, 15-31.
- Olakulehin, J.K (2002): Information and communication technologies in teacher training and professional development in Nigeria. *Turkish journal of Distance educational TODSE*, 8(1), 133-142
- Omufwoko, A. E., (2009). Factors Influencing the Use of Information and Communication Technologies for Learning among Students at Technical Colleges in Nairobi Province. Nairobi, Kenya
- Omwenga, E.L (2003) Pedagogical issues and E-learning cases: intergrating ICTS into teaching and learning processes. Available online at <http://scholar.google.com/scholar?q=omwenga+elijah%2c+thesis&btnG=8hl=0%2c5&as vis=1>
- One laptop per child (2010) press releases, retrieved from <http://laptop.org/en/utility/press/index.shthl>.

- Orodho, A. J. (2003). *Essentials of Educational and Social Sciences Research Method*. Nairobi: Masola Publishers.
- Passey D. (June 2006): technology enhancing learning: Analysing uses of information communication technologies by primary and secondary school pupils with learning frameworks. *The curriculum journal* 17(2), 139-166
- Pelgrum, W.J. (2001). Obstacles to the Integration of ICT in Education: Results from a Worldwide Educational Assessment. *Computers & Education* 37, 163-178.
- Pennuel W.R (2006): implementation and effects of one to one computing initiatives : a research synthesis. *Journal of research on technology in Education*, 38(3), 329-348
- Peralta, H., Costa, F.A. (2007). Teachers' competence and confidence regarding the use of ICT. *Educational Sciences Journal*, vol. 3, pp. 75-84
- Plomp, T., Anderson, R. E., Law, N., & Quale, A. (Eds.). (2009). *Cross-national information and communication technology: policies and practices in education*. Charlotte, N.C.: Information Age Publishing
- Plomp, T., Anderson, R. E., Law, N., & Quale, A. (Eds.). (2009). *Cross-national information and communication technology: policies and practices in education*. Charlotte, N.C.: Information Age Publishing.
- Plomp, Tj., ten Brummelhis, A.C.A., & Rapmund, R. (1996). *Teaching and Learning for the Future. Report of the Committee on MultiMedia in Teacher Training (COMMITT)*. Den Haag: SDU.
- Quaddus, M. and Hofmeyer, G. (2006). *Factors Influencing the Adoption of B2B Trading exchanges in Small Businesses in Western Australia: A Field study Approach*. The Tenth Pacific Asia Conference on Information Systems (PACIS 2006)
- Rangaswamy, A and Gupta S. (2000): *Innovation adoption and diffusion in the digital .Some research opportunities*
- Republic of Kenya (2005) sessional paper No. 1 of 2005, a policy framework for education, training and research Nairobi
- Republic of Kenya (2006) Kenya education sector support programme, 2005-2010
- Republic of Kenya (2006) the national ICT strategy for education and training Nairobi

- Richardson, J. (2000): ICT Implementation in education: an analysis of implementation strategies in Australia, Canada, Finland, and Israel. Ministry of education. Luxembourg
- Rodgers H. (2005): The status of elementary keyboarding. A longitudinal study. Retrieved on July 12 2015 from <http://www.edu/Rodgers/keyresearch/elemkeymanu2006.doc>.
- Rodgers, E. M. (1995). Diffusion of Innovations (4th Ed.). New York: The Free Press.
- Rodgers, P.L (2000): Barriers to adopting emerging technologies in education. *Journal of Education Computing Research*, 22(4), 455-472
- Rottman, J. W. and Lacity, M. C (2006). A review of the predictors, linkages, and biases in IT innovation adoption research. *Journal of Information Technology* (2006) 21, 1-23
- Salomon G. (1993) No distribution without individuals' cognition. In G salomon (Ed.) *Distributed cognitions: psychological and educational considerations* (pp111-138). New York: Cambridge University Press
- Schaffer, S. P., & Richardson, J. C. (2004). Supporting Technology Integration within a Teacher Education System. *Educational Computing Research*, 3(4), 423-435.
- Sife, A. S., Lwoga, E.T., & Sanga, C. (2007). New Technologies for Teaching and Learning: Challenges for higher learning institutions in developing countries. *International Journal of education and Development using Information and Communication Technology (IJEDICT)* 3(2) 57-67
- Stuart L.H mills, A.M & Remus U.C (2009). School leaders, ICT competence and championing innovations, *Computer and education*, 53(3), 733-741
- Tearlie P. (2004) A theoretical and instrumental framework for implementing change in ICT in education. *Cambridge Journal of Education*, 34(3), 331-351
- Teo T. (2008): preservice teachers attitudes towards computer use : a Singapore survey . *Australian journal of educational technology*, 24(4) 413-424
- Tezci (2009) Teachers effect on ICT use in education The Turkey sample. *procedia social and behavioral sciences*, 1,1285-1994
- Tezci, Erdogan (2011): Turkish primary school teachers' perceptions of school culture regarding ICT integration. Association for educational communications and technology . Incine published
- The government of Kenya () vision 2030, government publishers. Nairobi

- The ministry of education & the ministry of higher education science and technology (2012); sessional paper no. 14 of 2012; a policy framework for educational training; reforming education and training in Kenya. Nairobi. Government printers
- Tomei, L. A. (2005). *Taxonomy for the technology domain*. USA: Information Science Publishing.
- Tondear J., Hermans, R, Van Braak, J and Valke , M (2008) exploring the link between teachers educational beliefs profiles and different types of computer use in the classroom: computers in Human Behavior, 24(6) 2541-2553
- Tong, K.P., and Triniada, S.G. (2005). Conditions and constraints of sustainable innovative pedagogical practices using technology. *Journal of International Electronic for leadership in learning*, vol. 9, no.3, pp. 1-27
- Tong, K.P., and Triniada, S.G. (2005). Conditions and constraints of sustainable innovative pedagogical practices using technology. *Journal of International Electronic for leadership in learning*, vol. 9, no.3, pp. 1-27.
- UNESCO (2002a) information and communication technology in education: a curriculum for schools and programme of teacher development . pan France: Division of higher education , 4meslo . Retrieved May 29 2015 from <http://unesco.dol.unesco.org/images/0012/00129538epdf>
- UNESCO (2002b): information and communication technology in teacher education: division of higher education, UNESCO. Retrieved on March 17 2013 from [http://www.unescobkkk.org/en/education/ict/online-resources/e-library/library/themes/training of teachers/ict-in teacher-education](http://www.unescobkkk.org/en/education/ict/online-resources/e-library/library/themes/training%20of%20teachers/ict-in%20teacher-education)
- UNESCO (2008) ICT competency for teachers –implementation guidelines , version 1.0. retrieved on 28th September 2009 from [http://www.unesco.org/en/competency standards-teachers](http://www.unesco.org/en/competency-standards-teachers)
- Usluel, Y. K., Askar, P., & Bas, T. (2008). A Structural Equation Model for ICT Usage in Higher Education. *Educational Technology & Society*, vol. 11, no. 2, pp. 262-273
- Vannatta, R. & Fordham, N. (2004). Teacher dispositions as predictors of classroom technology use, *Journal of Research on Technology in Education*, vol. 36, no. 3, pp. 253-271.

- Vygotsky, L.S (1978) *mind in society: the development of higher psychological processes* , Cambridge MA : Harvard university press
- Wegerif, F. (1998): Social dimension of asynchronous learning networks. *Journal of asynchronous learning networks*, 2(1) 34-39
- Wenger E. (2008): *Communities of practice*. Retrieved July 14, 2008 from <http://www.ewenger.com/>.
- Williams M.D(2003): technology integration in education in Tan SC &Wong FL(Eds), *teaching and learning with technology*” pp 17-31: an Asia-Pacific perspective. Singapore, prentice Hall.
- Yildirim, S. (2007). “Current Utilization of ICT in Turkish Basic Education Schools: A Review of Teacher's ICT Use and Barriers to Integration”. *International Journal of Instructional Media*, vol. 34, no.2, pp. 171-86.
- Yilmaz, N.P. (2011). Evaluation of the Technology Integration Process in the Turkish Education System. *Contemporary Educational Technology*, vol.2, no.1, pp. 37-54.

APPENDICES

APPENDIX A: LETTER OF TRANSMITTAL

Zakayo Gikundi

P.O BOX 08-60607

Mikinduri

Dear sir/ madam

RE: PERMISSION TO COLLECT DATA

I am carrying out a research on factors influencing ICT integration in teaching and learning in public secondary schools in Tigania west Sub county Meru County. Once completed, this research will lead to an award of Master of Arts degree in project planning and management of the University of Nairobi.

Kindly allow me to collect data for this study in your County /Sub County/school.

Yours faithfully,

Zakayo Gikundi

APPENDIX B: TEACHERS QUESTIONNAIRE

The purpose of this study is to establish the factors influencing integration of ICT as a teaching and learning tool in public secondary schools in Tigania West Sub County. All your responses and information will be treated with confidentiality and only used for educational purposes of the study. Please give your views by filling in the blank spaces or putting a tick (✓) in the spaces provided.

SECTION A

1) What is your gender

2) How long have you taught in this school?

Months

Years

3) What is your highest academic qualification?

Diploma in education (without computer).....

Diploma in education (with computer).....

Degree e.g. B.ed (with computer as teaching or core subject).....

Degree e.g. B.ed (without computer as teaching or core subject).....

Masters

Untrained

4) Have you attended any refresher courses in computer studies?

Yes

No

If yes, in what way did it address the integration of ICT in teaching and learning?

.....

.....

.....

5) To what degree of adequacy did University/College media and instructional courses prepare you for use of ICT in teaching in secondary schools?

- None at all
- Little
- Some
- A lot

6) Please indicate whether you have undertaken any professional development courses in any of the ICT areas listed below? If so, please also indicate if you found it to be effective?

Professional development course	Have you undertaken it?		If so, Was it effective?	
	YES	NO	YES	NO
Training in the use of computers / basic computer skills/packages				
Curriculum Management				
Word processing (e.g. MSWord)				
Spreadsheets (e.g. Excel)				
Presentation software (e.g. PowerPoint)				
Databases (e.g. Access)				
Training on how to integrate technology within the curriculum				

7) Does the school have a Computer laboratory for teaching and leaning?

- Yes
- No

(b) If yes, list the hardware available for teaching and leaning.

.....

8) Does the school have a computer Technician?

Yes

No

(b) If yes what role does She/ he perform?

.....
.....
.....

9) Who maintains the ICT equipment in your school? Tick one box for each row

The school's own staff

An external company contracted by the school

An external unit arranged by educational

authorities (at local, regional level, etc.)

Other (Specify)

10) What type of support do the following provide you when you use ICT in teaching your lessons? Tick one box for each row

Service provider	Rarely/never used	Mostly technical support	Mostly pedagogical support	Both technical and pedagogical support
A more experienced / knowledgeable teacher				
School ICT/technology coordinator				
Other school staff				
Experts from outside the school				
An online helpdesk, community or website				

11) In case a problem occurs with the computers or ICT infrastructure, does the technician respond promptly?

- Strongly Agree
- Agree
- Neither Agree nor Disagree
- Disagree
- Strongly Agree

12) In case of trouble shooting are you capable of any rectification?

- Yes
- No

(b) If yes, List the areas you can handle in case of troubleshooting

- 1.....
- 2.....
- 3.....
- 4.....

13) Is the school connected to the internet?

- Yes
- No

(b) What is the mode of connectivity?

.....

14) Which type of application Software do you use in teaching and learning?

.....

15) How often do you use computers during teaching / learning at school

- Weekly
- Rarely

Daily

Never

16) Do students use computers on their own outside class time?

Yes

No

Integration

17) Please estimate how often you use ICT to achieve the listed personal/professional objectives.

Personal/Professional Objective	Daily	Weekly	At least once per term	Never
Create materials for students use (e.g. handouts, tests)				
Access research and best practices for teaching				
Curriculum administration (e.g. planning, monitoring, evaluating and reporting)				
Communicate with colleagues/other professionals				
Communicate with student(s) and/or students' parent(s)				
Post information to a website to assist your students in their work				
Online professional learning				

18) Is your school's capacity to integrate ICT in teaching and learning affected by a shortage or inadequacy in the following areas? Tick one box for each row

Shortage or inadequacy	A lot	Some	A little	Not at all
Insufficient number of computers				
Insufficient number of Internet-connected computers				
Insufficient Internet bandwidth or speed				
Insufficient number of interactive whiteboards				
Insufficient number of laptops/notebooks				
School computers out of date and/or needing repair				
Lack of adequate skills of teachers				
Insufficient technical support for teachers				
Insufficient pedagogical support for teacher				
Lack of adequate content/material for teaching				
Lack of content in national language				
Too difficult to integrate ICT use into the curriculum				
Lack of pedagogical models on how to use ICT for learning				
School time organization (fixed lessons time, etc.)				

School space organization (classroom size and furniture, etc)				
Pressure to prepare students for exams and tests				
Most parents not in favour of the use of ICT at school				
Most teachers not in favour of the use of ICT at school				
No or unclear benefit to use ICT for teaching				
Using ICT in teaching and learning not being a goal in our school				

APPENDIX C: STUDENTS' QUESTIONNAIRE

The purpose of this study is to determine factors influencing integration of ICT as a teaching and learning tool in public secondary schools in Tigania West Sub County. You are one of the respondents chosen to participate in the study. You are assured that all responses will be kept confidential and only used for education purposes. Please ensure that you respond honestly by filling the blank spaces or putting a tick in the appropriate spaces that corresponds with your responses.

Section A: General Questions

1) What is your gender?

2) What your age?

3) Do you like learning with computers?

Yes

No

If no, give reasons for your answer

.....
.....
.....
.....

4) Can you operate a computer?

Yes

No

If no, give reasons for your answer

.....
.....
.....
.....

If yes, give application packages you are proficient in/you are able to use

.....
.....
.....
.....
.....
.....
.....

5) How many times in a week do you practice on the computer?

Every day
Quite often
Not at all

6. indicate by ticking in the box provided the kind of personal work you are able to do using the computer

Accessing information on topics in the syllabuses
Accessing past examination papers
Receiving revision materials from teachers /colleagues
Doing assignments and posting them to the teacher
Sending and receiving emails
I do not do personal studies using a computer

APPENDIX D: INTERVIEW GUIDE FOR THE HEAD TEACHERS

The researcher is conducting a study on factors influencing integration of ICT as a teaching and learning tool in public secondary schools in Tigania West Sub County. You are among the several head teachers selected to assist with information on factors influencing integration of ICT as a teaching and learning tool in public secondary schools in Tigania West Sub County. Your correct responses were very important as it helped to solve the underlying problems. The information provided will be treated with utmost confidentiality and the researcher used your responses only for educational purposes.

1. In your own opinion what would you say about how availability of ICT infrastructure influences integration of I.C.T in teaching and learning in public secondary schools in Tigania West?

2. In your own opinion what would you say about how technical support influences integration of ICT in teaching and learning in public secondary schools in Tigania West Sub County.

3. In your own opinion what would you say about how teacher competence in ICT influences integration of ICT in teaching and learning in public secondary schools in Tigania West Sub County?

4. In your own opinion what would you suggest to be done to enhance integration of ICT in teaching and learning in public secondary schools in Tigania West Sub County?

APPENDIX E: OBSERVATION CHECK LIST

Equipments/facilities	Available	Not available	Remarks
Internet			
Printers			
Laptops			
Simulation Software			
Storage Devices			
Scanner			
Photographs/ slides			
Videos			
Journals/Newspaper			
Books			
Realia			
Desktop computers			
Fans			
White boards			
Hub			
Furniture			
Electrical fuse			
Anti-Virus Software			
Connection cables			
Technician			
First Aid Kit			
Computer Laboratory			