

**FACTORS INFLUENCING INTEGRATION OF INFORMATION
COMMUNICATION TECHNOLOGY IN PRIMARY SCHOOL SCIENCE
EDUCATION IN MOLO DISTRICT, NAKURU COUNTY, KENYA**

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the Award of a Degree of Master of Education in Curriculum Studies**

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DECLARATION

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

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DEDICATION

This work is dedicated to my children, Millicent, Brian, Moses, Debra and Samuel as a source of inspiration. May this work provide them with passion to treasure and cherish education for its own sake.

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ABSTRACT

Acquiring basic knowledge and skills on the use of information and communication technologies has become a necessity. Schools incorporate the use of ICT in lessons in order to enable them enhance the quality of teaching and learning. There are uncertainties about this relatively new teaching strategy concerning its effectiveness and factors that surround its integration. The purpose of this study therefore was to investigate factors that influence integration of ICT in primary school science education in Molo district. The study adopted a descriptive survey approach as the research design. The opinions of all the 85 science teachers in the 44 public schools were collected through a survey questionnaire and an observation checklist. The target population was all science teachers of primary schools in Molo district. All science teachers in public primary schools were selected to participate in the study. The data collection instruments were piloted in the neighbouring Kuresoi district, in order to determine their validity and reliability. Data were coded and analyzed using both qualitative and quantitative techniques and were presented in form of tables, graphs and pie charts. The findings revealed that that availability of in-service education and training opportunities for teachers, the attitudes of the teachers, the level of ICT competency among teachers and the availability of ICT resources affected integration of ICT in primary schools science education. It was also established that there was a general lack of ICT resources in the schools, and those found were located in the administrative office thus not being accessible for integration of ICT.

The researcher recommended increased in-service education and training opportunities for teachers in the integration of ICT, attendance of in-service education and training related to ICT integration be made a prerequisite for promotion so that the science teachers take it seriously, and adequate ICT resources be provided in all schools. In addition, the researcher also recommended that support services such as internet connectivity, electric power, and security needed to be assured for all schools. The researcher concluded that availability of in-service education and training opportunities for teachers affect integration of ICT in primary schools science education. It was also concluded that the attitudes of the teachers affected integration of ICT in primary schools science education. Also, it was concluded that the level of ICT competency among teachers affected integration of ICT in primary schools science education. Majority of them did not have the basic knowledge and skills to enable to effectively conduct integration of ICT in the classroom. In addition, it was concluded that the availability of ICT resources affected integration of ICT in primary schools science education. Majority of public primary schools lacked ICT resources. The researcher suggested similar study could be conducted on other subjects besides science education in primary schools to establish factors that influence integration of ICT in the teaching and learning process of the subject.

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ABBREVIATIONS AND ACRONYMS

CD	Compact Disc
DQASO	District Quality Assurance and Standards Officer
EFA	Education for All
ERSWEC	Economic Recovery Strategy for Wealth and Employment Creation
ICT	Information and Communication Technology
INSET	In-Service Education and Training
IRI	Interactive Radio Instructions
MoE	Ministry of Education
MOEST	Ministry of Education Science and Technology
MOPND	Ministry of Planning and National Development
SAS	Support Application Systems
SPSS	Statistical Package for Social Sciences
TV	Television
UPE	Universal Primary Education
USAID	United States Agency for International Development

CHAPTER ONE

INTRODUCTION

1.1 Background to the study

Information and communication technology (ICT) plays a key role in promoting the economic development of a country. Many of the productive gains in the developed world economies over the past two decades (1990-2010) can, to a great extent, be attributed to the impact of ICT. According to a United Nations report (1999) ICT covers internet service provision, telecommunications equipment and services, information technology equipment and services, media and broadcasting, libraries and documentation centres, commercial information providers, network-based information services, and other related information and communication activities. Kozma and Anderson (2002) observed that education is at the core of the knowledge economy and learning society and that correspondingly, the role of ICT in the teaching and learning process in schools is increasing rapidly.

The benefits of integrating ICT in teaching and learning in South African schools are pedagogical and administrative in nature (Chigona, Chigona, Kayongo, & Kausa, 2010). From a pedagogical viewpoint, introducing ICT in schools is effective, as it enhances teaching and learning and prepares students for participation in the workforce (Hadden, 2006). Keong, Horani and Daniel (2005)

posit, that “ICT supports constructivist pedagogy, wherein students use technology to explore and reach an understanding of concepts”. According to Hennessy and Deaney (2004), in order for technology to be integrated and embraced, there must be a move away from traditional teaching models to more innovative methods, such as a constructivist approach which promotes higher order thinking and problem-solving skills.

The national ICT policy in Kenya envisages harnessing the potential of ICTs and emerging technologies to eradicate poverty, support Universal Primary Education (UPE), and improve maternal health among others. In the area of human resource development, the policy emphasizes integrating ICT in teaching curriculum at all levels of education, establishing educational networks for sharing educational resources and promoting e-learning at all levels. It also proposes encouraging and supporting ICT training for decision-makers and enhancing capacity for research and development. The Ministry of Education, sector partners and stakeholders have developed the National ICT Strategy aimed at guiding the sector in the adoption of ICT across all levels of education and training. The ICT strategy was adopted and utilized to improve access, quality and equity in the delivery of education services and is based on the fact that: “ICT is a universal tool in education and training”. The overall objective of the plan is to ensure that systematic efforts are made towards strengthening adoption and use of ICT in the education sector with appropriate attention given to education development

priorities as outlined in the Economic Recovery Strategy for Wealth and Employment Creation (ERSWEC), (Ministry of Education Science and Technology, 2006).

The Government of Kenya appreciates and recognizes that an ICT literate workforce is the foundation on which it can acquire the status of an industrialized country. Based on this, the government promised its citizens to make education the natural platform for equipping them with ICT skills in order to create a dynamic and sustainable economic growth (MOEST, 2005). According to Sessional Paper no 1 of 2005 on a Policy Framework for Education, Training and Research of the Ministry of Education, the overall goal of education is to achieve Education for All (EFA). In pursuit of the policy objective the government introduced Free Primary Education (FPE) in 2003 that led to a dramatic rise in enrolment that has stressed the inadequate teaching force and physical infrastructure (USAID-Kenya, 2013). The challenges arising from the increased enrolment rates include overcrowded classrooms and high pupil-teacher ratios particularly in densely populated and semi-arid areas. Although not adequately equipped in all subject areas, teachers are required to teach seven subjects of the primary school curriculum. The cost of teaching and learning materials has remained high. The pupil-text book ratio is high in most areas. These challenges may have led to the observed poor performance in mathematics and science in

national examinations. Integration of ICT can contribute considerably to addressing these challenges (Sang & Kipsoi, 2005).

The vision of the Ministry of Education in Kenya is to facilitate the use of ICT as a universal tool for education and training. In order to achieve this vision every educational institution, teacher, learner and the respective community should be equipped with appropriate ICT infrastructure, competencies and policies for usage and progress. The vision calls for recognition of the fact that ICT provides capabilities and skills needed for a knowledge-based economy. In addition, the vision aims at transforming teaching and learning to incorporate new pedagogies that are appropriate for the 21st century. The Ministry of Education Science and Technology (MOEST) mission was to facilitate effective use of ICT to improve access, learning and administration in delivery of education programmes and services at all levels of education, (MOEST, 2006).

The content of the curricula should take account of the 21st century classroom. Teachers should be trained on the state-of-the-art hardware and software that will become common in the 21st century classroom. Training in technology should encompass telecommunications, satellite access, networking, the internet, video-conferencing and digital components as well as optical technology. These technologies will permit the 21st century teacher in the 21st century classroom feel comfortable and teach effectively and efficiently. The use of new

technologies in the classroom is essential for providing opportunities for students to learn to operate in an information age. It is evident as Yelland (2001) argued, that traditional education environments do not seem to be suitable for preparing learners to function or to be productive in the workplace of today's society. She claimed that organizations that do not incorporate the use of new technologies in schools cannot seriously claim to prepare their students for life in the 21st century. A similar argument had been presented earlier by Grimus (2000) who pointed out that by teaching ICT skills in primary schools, the pupils are prepared to face the future with developments based on proper understanding.

When used in proper ways, ICT can improve education in many ways. The use of computers in education can be more efficient, it can provide better learning results and it can be made adaptive to the individual learner. But also important is the fact that it can be fun to learn with computers. Skills like collaboration, critical evaluation, receiving feedback, planning and organisation can be learned (Emans, 2007). Its use will provide new opportunities for more student-centred teaching, opportunity to reach more learners, greater opportunity for teacher-teacher, and student-to-student communication and collaboration, greater opportunities for multiple technologies delivered by teachers, creating greater enthusiasm for learning amongst students ,and offering access to a wider range of courses. Due to ICT's importance in society and possibly in the future of education, identifying the possible factors that hinder the integration of these technologies in schools

would be an important step in improving the quality of teaching and learning (Khalid, 2008). Individual teachers now have the responsibility to think about ways to use ICT within their daily lessons.

When considering the role of ICT in enhancing children's science learning, recent studies of the brain, such as the one reported by Greenfield (2000), have led to 'network' model of learning. This model of learning predicts that active learning, such as that promoted by constructivist teaching approaches, in which children are engaged in knowledge construction, enables more pervasive neural connectivity and hence enhanced science learning. The use of ICT can facilitate more constructivist teaching in the primary school. Integration of ICT can support both the investigative (skills and attitudes) and more knowledge-based aspects (concepts) of primary science. The more recent approaches to science learning, particularly the social constructivist methodologies, highlight the importance of verbal as well as written communication as being vital for children to construct meaning. The use ICT can greatly enhance the opportunities for children to engage in effective communication at several levels (Greenfield 2000).

Integration of ICT entails the use of computer – related devices to facilitate teaching and learning process. Potential benefits from the use of ICT for science learning have been reported in several research studies. According to Gilliespie, (2006), the use of ICT encourages communication and collaboration in science

learning. New technologies can be used in primary science education to enable students to collect science information and interact with resources, such as images, and videos, and to encourage communication and collaboration. Murphy (2006) reviewed the impact of ICT on the teaching and learning of science in primary schools. She indicated that the internet is used in primary science both as a reference source and a means of communication. New technologies may also help increase motivation (Osborne and Collins (2000), facilitate clear thinking and develop interpretation skills of data (Newton and Rogers 2003). Using ICT in science education also expands the pedagogical resources available to science teachers (Al-Alwani, 2005). Pickersgill, (2003) explored effective ways of utilizing the internet when teaching science. He found that ease of internet access allows teachers to help students to become experts in searching for information rather than receiving facts. He claimed that it could increase students' awareness of the importance of the world around them, citizenship and of a scientifically literate community. While Keller, (2000) wrote that ICT cannot replace normal classroom teaching his study found out that ICT could introduce positive forces in classrooms for a deeper understanding of principles and concepts of science and could be used to provide new, authentic interesting motivating and successful educational activities. (Keller, 2000).

In Kenya, primary science education is a core subject and the backbone of technological advancement that is envisaged in our development strategy; Vision

2030. At KCPE, performance in various subjects for the last 4 years has been as shown in Table 1.1.

Table 1.1

National performance at KCPE for the period 2008-2011

Subject	Paper	Year			
		2008	2009	2010	2011
English	English language	41.58	45.76	49.12	47.10
	English composition	40.48	41.85	42.70	42.45
Kiswahili	Kiswahili lugha	56.60	57.28	52.76	41.46
	Kiwahili insha	51.58	53.68	50.30	54.68
Mathematics		47.16	49.56	53.80	52.18
Science		55.24	59.92	60.86	67.48
Social studies	Social studies	61.35	62.42	64.93	56.32
	Religious education	60.41	61.60	60.07	62.45

Source: The Year 2011 KCPE report, from KNEC

Over the four year period, performance in English, mathematics, and science had improved, science being the most improved subject. Kiswahili lugha and social studies recorded a decline. On average, English recorded the lowest performance followed closely by mathematics. It was only science that had a consistent

improvement for the 4 year period. In 2008, the national mean performance was 55.24% and in 2011 the mean score had gradually risen to 67.48% which was quite good. In 2011, science was the best performed subject. Most of the subjects recorded average performance. Overall performance could be improved if more innovative ways of teaching such as integrating ICT in the teaching and learning process can be embraced in our schools. Introducing ICT in schools is effective, as it enhances teaching and learning and, in addition, prepares students for participation in the workforce, (Hadden, 2006).

In the year 2008, Nakuru County had 5 districts. For the purpose of this study, performances at KCPE in science education in the five districts have been compared in the Table 1.2.

Table 1.2

Performance in science education in the five initial districts of Nakuru County

District	Year				
	2008	2009	2010	2011	2012
Molo	45.24	44.92	46.78	46.70	47.47
Naivasha	44.53	48.69	50.14	48.80	49.22
Kuresoi	46.11	53.61	49.84	49.13	51.11
Nakuru municipality	47.42	49.12	48.99	48.60	50.20
Rongai	46.14	45.15	47.21	47.42	46.11

Source: Nakuru County Education Office, 2013

Between 2009 and 2011, Molo district performed relatively poorer than the other districts in the county. Over the four year period, the performance in Molo District had improved from 44.92% in 2009 to 47.47% in 2012, surpassing the performance of Rongai district in the process. Except Kuresoi, all the other districts had experienced an improved performance in the period under study. Molo district had made the largest improvement in the period under study, thus making more suitable to conduct this study on factors that influence integration of ICT in primary science education.

By comparing the performance in science in Molo District (Table 1.1) with that of the entire country (Table 1.2), it is evident that performance in Molo District has been lower than the performance in the same subject nationally. Measures should be put in place to address this poor performance in the district. Integration of ICT in the teaching of science education can go a long way in alleviating this dismal performance. According to Hord (1998) successful implementation of innovations such as integration of ICT in education requires adequate training of teachers through in-service programmes, changing their attitudes, and providing adequate and appropriate resources.

1.2 Problem statement

Yelland (2001) argued that traditional education environments do not seem to be suitable for preparing learners to function or to be productive in the workplace of today's society. She claimed that organizations that do not incorporate the use of new technologies in schools cannot seriously claim to prepare their students for life in the 21st Century. The pupil-text book ratio is high in most areas and this has led to the observed poor performance in mathematics and science in national examinations (USAID-Kenya, 2013). The dramatic rise in enrolment has further stressed the inadequate teaching force and physical infrastructure (USAID-Kenya, 2013). Many primary schools are understaffed as a result of the free primary education program. In Molo District, performance in science is lower than the performance in the same subject nationally. Integration of ICT in the teaching and

learning in science education may help in addressing these challenges. Despite the effort made to integrate ICT in teaching science, very little has been achieved. This study, therefore, investigated the factors that influence integration of ICT in primary schools science education in Molo District.

1.3 Purpose of the study

The purpose of this study was to investigate the factors that influence integration of ICT in primary schools science education in Molo district.

1.4 Research objectives

The study was guided by the following objectives:

- i. To establish the extent to which in-service education and training opportunities for teachers affect integration of ICT in primary schools science education in Molo district
- ii. To determine the extent to which attitudes of the teachers affects integration of ICT in primary schools science education in Molo district.
- iii. To establish the extent to which the level of ICT competency among teachers affects integration of ICT in primary schools science education in Molo district
- iv. To establish the extent to which the availability of ICT resources affects integration of ICT in primary schools science education in Molo district

1.5 Research questions

The following research questions were used to guide the study:

- i. How does availability of in-service education and training opportunities for teachers affect integration of ICT in primary schools science education in Molo district?
- ii. To what extent does the attitudes of the teachers affect integration of ICT in primary schools science education in Molo district?
- iii. To what extent does the level of ICT competency among teachers affect integration of ICT in primary schools science education in Molo district?
- iv. How does the availability of ICT resources affect integration of ICT in primary schools science education in Molo district?

1.6 Significance of the study

It is hoped that the findings of this study may contribute to the existing pool of knowledge on the content of INSETs offered to teachers by the Ministry of Education especially those related to acquisition of skills on integration of ICT in primary school science education. The findings may also help curriculum planners to devise implementation processes and techniques that are more effective and efficient. The Kenya Institute of Curriculum Development may also use the findings of this study to improve on the current primary school curriculum, and possibly come up with a curriculum that leads to high level competency among teachers on integration of ICT in primary school science

education. The Teachers Service Commission may use the findings of this study to recommend qualities that the teachers entering the teaching service should have. The Ministry of Education and the County Governments may also find the study useful in allocating ICT resources in primary schools. The Education Quality Assurance and Standards Council may also use the findings of this study in monitoring and evaluation of teaching and learning activities to ensure that ICT is effectively integrated in the classroom activities. Finally, teachers, heads of subject panels and head-teachers may find the study useful in enhancing their roles in the actual teaching or supervising the teaching and learning process.

1.7 Limitations of the study

The process of integration of ICT in science education was not widely embraced in primary schools and as such the available literature was limited. In addition attitude of teachers towards integration of ICT in science education may have been formed; thus influence the outcome of the study. Finally the descriptive survey design used in this study may not completely capture the information as required.

1.8 Delimitations of the study

The study was limited to public primary schools in Molo district of Nakuru county. Public primary schools are homogenous and receive essential support

services from the Ministry of Education. The respondents were the entire science teachers in each of the schools.

1.9 Basic assumptions of the study

In this study, it was assumed that all the respondents had the appropriate knowledge required in this study and provided the required responses on the questionnaire. It was also assumed that the respondents were aware of the policy guidelines on integration of ICT in the classroom.

1.10 Definition of significant terms

For the purpose of this study, the listed terms were used as defined.

Attitude refers to a learned tendency to evaluate things in a certain way. It can include evaluations of people, issues, objects or events.

Information and communication technology competency refers to the ability to use and operate computer related tools and equipments for the purpose storage, analysis, and relaying of information and communication.

Information and communication technology refers to information communication technology that encompasses the use of computers and other related devices to enhance various modes of communication.

Information and communication technology resources refer to computer related hardware and software that is used to enhance storage, analysis, and relaying of information and communication.

In-service education and training refers to the capacity-building opportunities offered to staff in the service.

Integration refers to the act or process of combining so that they work together.

Integration of ICT refers to the use of computers, projectors, scanners or other related devices to enrich various channels of communication that are used during the teaching and learning process.

Pupil-teacher ratio refers to is the number of pupils enrolled in primary school divided by the number of primary school teachers regardless of their teaching assignment

1.11 Organization of the study

This study is organized into five chapters. The first chapter is the introduction that comprise background of the study, statement of the problem, objectives, research questions, purpose of the study, significance, limitations, delimitations, assumptions, definition of significant terms, organization and the theoretical framework of the study. The second chapter is the review of related literature and discusses ICT integration, science education, INSETs implementation process, ICT competency among teachers, and ICT resources. The third chapter outlines the research methodology and includes research design, population, sample size,

sampling techniques, data collection instruments, data collection procedures and data analysis. Chapter four comprises data analysis, and discussion of the findings. Finally, chapter five consists of the summary of the findings, conclusions recommendations and suggestions for further research.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter reviewed the relevant literature that provided information related to the research area by relating it with previous studies and thus facilitated interpretation of the results of the study. The integration of ICT in education, science education, ICT training opportunities, INSETs, ICT competency among teachers, and ICT resources was looked at in Kenya and selected African countries and the rest of the world.

2.2 Integration of ICT in education

Integration of ICT is composed around three central ideas ICT is always a mean of achieving other teaching objectives; ICT is a powerful instrument to cope with social inequity and to help students with learning difficulties; and ICT integration is an instrument to stimulate cooperative learning among pupils. Putting this into practice teachers mainly make use of ICT in their individual classrooms. ICT activities are always related to other curriculum objectives like reading, writing, mathematics or social competencies. ICT is further used by pupils to give presentations to each other and to communicate to other classes and parents. Teachers use interactive whiteboards during all their classroom activities. Pupils themselves write on these weblogs. In kindergarten, teachers make use of digital

stories and pupils learn to use basic software packages. Schools lend out computers without charge to pupils from under-privileged families so that all children have the opportunity to work with ICT and to communicate with their teacher from home (Vanderlinde and Braak, 2010). Information communication technology was introduced in the public primary schools of Cyprus in 2001 not as a discrete subject, but as a learning tool that should be integrated in all subjects of the curriculum (Doratis, 2007).

The European Union (EU), recognizing the necessity to keep up with the rapid technological changes and to enhance lifelong learning among its citizens, promoted a strategic framework in order to improve the overall quality of life and to meet the challenges of globalization, ageing, and the ICT revolution (Dion, 2005). The success of the strategy was made a reality by the integration of ICT in education, since education prepared future citizens to learn and use ICT in daily life and work. Therefore, EU countries invested huge amounts of money to integrate ICT and modernize their educational and training systems in order to meet the demands of the knowledge-based economy and society (Dion, 2005).

The Ministry of Education's mission is to facilitate effective use of ICT to improve access, learning and administration in delivery education programmes and services (MOE, 2006). In order to achieve this, every educational institution, teacher, learner and the respective community should be equipped with

appropriate ICT infrastructure, competencies and policies for usage and progress. It calls for transforming teaching and learning to incorporate new pedagogies that are appropriate for the 21st century. The principal objective will be to integrate ICT in the delivery of education and training curricula (MOE, 2006).

While western countries have reported up to 41% of integration of ICT to teaching and learning, the proportion remains substantially low in Africa, Kenya included. Integration aims at the use ICT to support teaching and learning in the delivery of the various curricula to achieve improved education outcomes. Because ICT is interactive media, it facilitates students to develop diversified skills needed for industrialization and a knowledge-based economy. It also allows teachers and learners to proceed at different paces depending on the prevailing circumstances (Ogutu, 2008). As a first step, the Ministry of Education initiated a major ICT project in Secondary schools meant to equip over 200 secondary schools with ICT infrastructure for integration of ICT in teaching/learning process (KESSP, 2004). Three schools have been chosen in every district of Kenya.

2.3 Primary school science education

In Kenya, science is a key subject that children study at all institutions of learning from early childhood to university. Science subjects are critical in providing students essential skills needed for accelerating economic growth through industrialization and advancement in technology (MOEST, 2005). In addition, science is considered critical in the attainment of Vision 2030, which outlines

Kenya's development road map and what economists envisage the country would become economically and technologically (MPND, 2008). Currently, MOE is exploring strategies that make science accessible to all learners through instructional approaches that emphasize everyday life experiences of the students in science instruction. These instructional approaches are intended to demystify science subjects as an elitist subject and instead become a subject that is accessible and affordable to every child in the society (MOEST, 2005).

The Ministry of Education is training with the assistance of Japanese Government primary teachers in new approaches to teaching science through a project known as Strengthening Mathematics and Science Education (SMASE). This new approach is geared towards improving the performance in science and making the teaching and learning of science learner-centered (Ng'asike, 2012). The current reform efforts in mathematics and science education recognize the crucial role that teachers play and thus target them as curriculum innovators and implementers through in-service education and training. There is growing consensus that improving students learning depends on a teaching force with appropriate beliefs and attitudes towards teaching and learning, who possess content and pedagogical knowledge quite distinct from the usual instructional practice in most classrooms (Ogwel, 2013).

According to the ICT guidelines for educational institutions on integration, infrastructure and acquisition of essential resources, released by the Ministry of Education in (2010) costs involved in integrating technology in education is high and as such the implementation of integration of ICT will be done gradually. Provision of one or more computers will be adequate for a start. It is important for institutions to plan on how they want to use technology in their teaching and learning and what they require over the years. The schools are urged to first reflect on why they want to integrate technology in their institution before deciding what kind of technology is required. It is imperative that schools adopt a balanced integration of ICT in the classroom ; that is planning for both the pedagogical use of technology as well as about the specifications and acquisition of the technology (MOE, 2010)

In Kenya, a change in curriculum will require that tutors of colleges get additional skills to cope with emerging teaching approaches related to curriculum adjustments. However, the reality on the ground is that tutors rarely get induction training when a new curriculum is launched by the MOE. For example, the curriculum review of 2002 by the MOE recommended that subjects taught in primary school be reduced from eight to five. In addition, teachers who qualify to teach at primary level are not necessarily competent in science instruction as some might have taken arts subjects during their second year of training. However, even those who feel competent to teach science find themselves teaching the integrated

curriculum. Teaching the integrated curriculum means that the teacher in some understaffed elementary schools will teach science content knowledge that he/she has not studied. For instance, teachers who learned home science will be required to teach biological or physical sciences in the integrated science curriculum. This is also the challenge the tutors face when teaching the integrated curriculum during the first year of the training in the colleges. Most of them find themselves teaching science areas they have never studied, including courses like agriculture and home science (Ng'asike, 2012).

2.4 In-service education and training

According to MOE, 2005, it is important for Kenya's teachers to be exposed to contemporary and relevant experiences in using modern methods and media including ICTs in curriculum delivery. The Sessional Paper No 1 of 2005 "A Policy Framework for Education, Training and Research" has a comprehensive focus for teacher development and utilization under which the in-service training of teachers is a priority area. The policy articulates the need for continuous improvement in the quality of services through continuous skills upgrading for teachers. The rationale is to address past weaknesses of practicing teachers by giving them skills beyond those acquired during pre-service training. In the Kenyan context, the quality of education is heavily dependent of the quality of staff, their motivation and the leadership they experience. The quality of teaching depends on the quality of the teachers, which in turn depends to some extent on the quality of their professional development (Bundi, 2012).

In the area of human resource development, the national ICT policy in Kenya emphasizes integrating ICTs in teaching curriculum at all levels of education; establishing e-educational networks for sharing educational resources and promoting e-learning at all levels; encouraging and supporting ICT training for decision-makers, community and civil society leaders; creating opportunities and providing assistance for the disadvantaged, women and the youth to acquire ICT competencies and skills; and enhancing capacity for research and development in ICT sector. It had not been established whether availability of INSETs influences integration of ICT in primary science education in Molo District. This study intended to fill this gap.

2.5 Attitude of the teachers towards integration of ICT in education

Psychologists define attitudes as a learned tendency to evaluate things in a certain way. This can include evaluations of people, issues, objects or events. Such evaluations are often positive or negative, but they can also be uncertain at times. For example, you might have mixed feelings about a particular person or issue. Researchers also suggest that there are several different components that make up attitudes. An emotional component explains how the object, person, issue or event makes you to feel. A cognitive component illustrates your thoughts and beliefs about the subject, while a behavioral component expresses how the attitude influences your behavior. Attitudes form directly as a result of experience. They

may emerge due to direct personal experience, or they may result from observation. Social roles and social norms can have a strong influence on attitudes. Social roles relate to how people are expected to behave in a particular role or context. Social norms involve society's rules for what behaviors are considered appropriate (Hockenbury and Hockenbury, (2007)

A study that was conducted among primary school teachers in Cyprus in 2004 revealed that 53% of the teachers hold negative attitudes towards computer technology integration in their classroom practices (Eteokleous, 2008). Actually, the user's acceptance is considered an important element in the successful implementation of technology in the instructional setting, and which is greatly influenced by the users' attitudes towards technology. Moreover, Teo (2008) believes that attitudes towards computers and trust in using them in education are two major predictors for teachers' future use of technology in classrooms. Levin and Wadmany (2007) emphasize the importance of a clear focus on teachers' attitudes, values, and beliefs as a primary focus in supporting learning.

In a study, Bakr (2011) explored the attitude of high school English teachers in Syria toward ICT and investigated the relationship between computer attitude and five independent variables: computer attributes, cultural perceptions, computer competence, computer access, and personal characteristics (including computer training background). The findings suggest that teachers have positive attitude

towards ICT in education and their attitudes were predicted by computer attributes, cultural perceptions, and computer competence. Moreover, the results clearly emphasized the importance of teachers' vision of technology itself, their experience in using it, and the cultural conditions surrounding its introduction into schools, on shaping teachers' general attitude towards technology and its subsequent diffusion in their educational practice. It has not been established whether attitude of teachers influences integration of ICT in primary science education in Molo District. This study intends to fill this gap.

2.6 Information and communication technology competency among teachers

In Guyana, the ICT Professional Development Strategy for Teachers holds the promise of identifying a rapid and cost-effective way to enhance and overhaul existing teacher education systems in environments with few resources and limited human capacity. As the name suggests, ICT is being used to leverage advantage by accessing quality free resources such as curriculum frameworks, teaching and learning resources, and online tools. The strategy acknowledges the central role that education officials, teacher trainers, educators, and students play for it to be realized. The strategy rests on an assumption that, by revising teacher education to embrace ICT, improvements in student performance can be derived. Despite the strategy being devised to respond to challenges in Guyana it can potentially, with some degree of adaptation, be replicated in developing countries with similar issues or provide some potentially relevant lessons. In response to

these statistics the MOE has prioritized increasing the number of qualified teachers by providing further opportunities for both pre- and in-service teachers to gain accreditation. As a crucial component of its strategy, the Ministry identified educational technology, with concurrent development in teacher ICT competencies, as the agent of change in this process. Consequently teacher education and training, supported by technology, has been placed at the forefront of efforts to tackle ineffective teaching and low quality of learning in classrooms. This is a challenge in a country where only 27% of the population is identified as Internet users. The Ministry of Education's ICT operational plan recognizes that integration of ICT into education is based on addressing issues of content, access, competency, and the actual integration of ICT into teaching and learning, which is intricately tied with teacher and student competencies in the available technologies (MOE, 2006). It had not been established whether ICT competency among teachers influences integration of ICT in primary science education in Molo District. This study intended to fill this gap.

2.7 Information and communication technology resources

Teachers can neither teach computer skills nor integrate ICT into curricula without having at their disposal computers that work. Clearly, a lack of appropriate material resources inhibits learning and causes frustration and resistance in school communities. Further, appropriate full-time technical support and significant opportunities for teacher education in the integration of ICT in the teaching and learning process are necessary if teachers are to move toward

curricular integration and meaning making (Granger, Morbey, Lotherington, Owston and Wideman, 2002)

The term ICT embraces a range of technologies broadly concerned with information and communication. The popular idea of ICT hardware in the classroom or computer suite includes one or more multimedia desktop computers or laptops and a combination of the following: digital camera, printer, scanner, CD-writer, data projector, interactive whiteboard, electric board, audio cassette, radio for interactive radio instructions, Video/TV-learning, Computer, integrated ICT infrastructure and support application systems robot and, in science classes, data loggers and perhaps a digital microscope. There will be a range of software available on the hard drive of the computers and as add-ons (usually as floppy discs or CD-Roms) (Ogutu, 2008). The machines may or may not be networked or have access to the Internet. How these facilities might improve the learning and teaching of primary science in terms of the development of the scientific skills, concepts and attitudes.

The world is going the digital way, and education is at the forefront of this journey but Kenya is lagging behind. According to Kinuthia (2009), computers were introduced in Kenya in the 1970s and the internet became available in 1993. By March 2008, only 7.9% of the population had access to the internet. While the

number of internet service providers continues to grow, access is still limited, especially in the rural areas.

In her study titled “Adoption and Use of ICT in Enhancing Management of Public Secondary Schools in Wareng District” Nganga, (2010) noted that benefits of using ICT in schools is undisputed. There is a general agreement that ICT has positive effects in the school management as most respondents agreed with the statement that ICT makes teaching more effective, makes lesson plans richer, helps in organizing professional tasks, and helps in meeting varying needs of the students. The study also found out that when the use of ICT was adopted by the school management, it had a positive effect on school performance. The study further established the challenges schools faced in adoption and use of ICT as follows:- lack of technical support, lack of interest in ICT adoption and use, inadequate personnel, poor infrastructure, and lack of computers and related software (Nganga, 2010). The major challenge in respect to integration of ICT is limited equipment at virtually all levels of education. While the average access rate is one computer to 15 students in most of the developed countries, the access rate in Kenya is approximately one computer to 150 students (EMIS, 2005).

2.8 Theoretical framework

The theoretical framework will be based on the normative process theory that was developed by May,(2009) and explains the social processes through which new or modified practice of thinking, enacting, and organizing work are

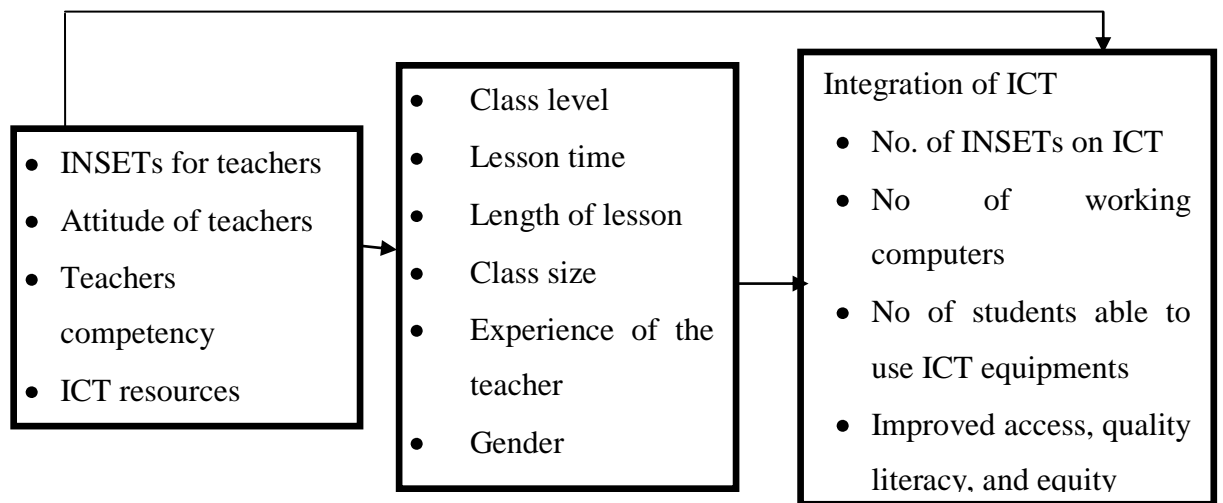
operationalized in education, healthcare and other institutional activities. The theory has three core elements namely implementation, embedding and integration. Implementation is the process social organizations bring a practice or practices into action. The organizational members must have clear understanding of the proposed innovation and how it is implemented. In this case, teachers already have a clear understanding of integration of ICT from their initial training. Embedding, mean the processes through which a practice or practices become, (or do not become), routinely incorporated in everyday work of individuals and groups. Teachers should be informed about integration of ICT while in the field. This will sensitize them on how to integrate ICT in the curriculum, especially in science education. Hence, teachers will develop positive attitudes in implementing the innovation. Finally, integration is the process by which a practice or practices are reproduced and sustained among the social matrices of an organization or institution. Individuals within the organization must be given the skills and possess capabilities required for carrying out the innovation. By doing this it will help teachers identify the loopholes in the approaches used in integrating ICT in science education; hence suggest ways in which those skills if lacking may be developed. Though teachers may have some skills from pre-service training, integration of ICT is a continuous process that needs to be updated with emerging skills, through planned in-service education and training for teachers.

The necessary materials and equipment for innovation must be provided. Here, the head-teachers should involve the science teachers in suggesting what materials will be necessary. Once available, it will be easy for teachers to integrate ICT in the science teaching. The school itself must be modified so that it is compatible with the innovation being implemented. This will include space and schedules in the school. For instance, integration will require creating room for storage of ICT resources, and providing essential support services. The school can also arrange time and days for pupils to practice using the resources. As such, normative process theory was found to be quite appropriate for the study on factors influencing integration of ICT in the primary school science education in Molo district.

2.9 Conceptual framework

Figure 2.1

Conceptual framework showing the relationship between independent and dependent variables.



A contextual framework was used as a basis for guiding this study. This model for assessing education quality is adopted from EFA Global Monitoring Report, 2002 which depicts education as a productive system, in which inputs are transformed into outcomes. This framework helped to define quality and to categorize different measures of efficiency in education. The input-process-outcome context framework was used to define the independent variables (INSETs for teachers, attitude of teachers ICT competency, and ICT resources,), dependent variables (integration of ICT) and moderator variables (class level, lesson time, length of a lesson, class size, experience of the teachers, and gender). When effective integration of ICT is adopted in education and training, it can translate into

improved access, quality and equity in the delivery of services (MOE, 2006). In the conceptual framework below, the first box contains the independent variables, in this case factors that influence integration of ICT in the teaching of science in primary schools. The central box shows moderator variables namely class level, lesson time, length of a lesson, class size, experience of the teacher and pupil's gender. The last box shows the dependent variables and indicators of integration of ICT in primary school science education. Effective integration of ICT would gradually transform the inputs in the dependent variable through a process, into tangible results that could be observed through the dependent variables.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter discussed the research design, target population, sample and sampling procedure, research instruments, validity, reliability as well as data collection procedures and analysis techniques.

3.2 Research design

The study adopted a descriptive survey research approach. According to Kathuri and Pals (1993), survey research design aims at exploring and describing beliefs, observations, and behaviours of the respondents. Mugenda and Mugenda (2003) define surveys as an attempt to collect data from members of a population in order to determine the current status of that population with respect to one or more variables. They further assert that information collected through surveys may be used for various purposes, for example to evaluate product acceptance and use. A survey uses questionnaires, interview schedule and checklist to determine opinions, attitudes, preferences and perceptions of the science teachers towards integration of ICT in the teaching and learning process.

This study intended to determine factors that influence integration of ICT in primary science education. From the nature of the study and the information that it intended to gather, a survey approach was the most appropriate. The design

was suitable for the study because the researcher was interested in establishing the actual factors that influenced integration of ICT in the primary schools.

3.3 Target population

Molo District had 53 primary schools of which 44 were public. The public primary schools had 85 science teachers. The target population was the 85 science teachers who were teaching in the 44 public primary schools in the district. The teachers were qualified and uniformly distributed in all the schools in the district (Molo District Education Office, 2013).

3.4 Sample size and sampling procedures

Census survey was used to select all the public primary schools in Molo District to participate in the study. Sampling is the process of selecting a number of individuals for study in such a way that individuals selected represent the larger group from which they are selected, thus representing the characteristics found in the entire group (Orodho, 2003). The more the sample size approaches the population size the more representative it is. Mulusa (1998) states that in small population of 30 cases or less it is possible to leave out one or two cases which would not make much difference to the resources and time required. Hence, in this study all the 44 public primary schools and all the 85 science teachers in those schools were used since the population was small.

3.5 Research instruments

A questionnaire and an observation checklist were used to collect data for this study. The instruments were constructed by the researcher. The questionnaire had sections A to E. Section A sought to collect bio data from the respondent. Section B to E comprised structured questions that aimed at collecting data on specific study objectives. The questionnaire was used to establish opinions and perceptions from the science teachers on the status of integration of ICT in the school and factors that might be influencing it (Best & Kahn, 2001). According to Kathuri and Pals, (2004), the questionnaire is quite often considered appropriate for survey operations. The observation checklist was used to determine the actual status of ICT resources in the school. It was completed by the researcher.

3.6 Instrument validity

Pilot study was carried out on a population similar to the target population (Mulusa, 1988). This was done using five teachers from the neighbouring Kuresoi district. The objective was to assess the clarity of the items in the instrument. Items found inadequate were modified to improve the quality of the instrument; hence its validity. In addition, the researcher sought expert opinion on content validity of the instrument used in the study.

3.7 Instrument reliability

To ensure reliability of the instruments, the test retest method was used. This involved administering the same questionnaire at an interval of one week to the

same group and then compared the two scores. This was aimed at finding out if the results were consistent to determine the reliability of the instrument. Respondents used in the pre-test phase did not participate in the study since it was done in the neighbouring Kuresoi district. This helped control extraneous influence on the research findings due to prior knowledge of the information required in the instrument. Five teachers in different schools used for the purpose of the test retest.

The reliability coefficient was ascertained using Cronbach alpha and was found to be 0.7431. This coefficient was preferred because it is useful when measuring the reliability of interval data. According to Mujis (2004) an instrument that yielded a reliability coefficient of alpha greater than 0.7, is considered good for data collection. For the qualitative data, reliability was obtained by converting data into relevant numbers and determining efficacy based on the results.

3.8 Data collection procedures

Following the approval by the university to collect data upon satisfying the basic requirements, the researcher sought permission from the National Council for Science and Technology, to carry out the study within Molo district. This was followed by a visit to the Molo District Education Office for endorsement by being issued with a letter of introduction. In addition, the researcher visited the schools involved in the research to notify and seek permission from the head-teachers so as to be allowed to carry out the intended study. A questionnaire and

an observation checklist were used in the collection of data. The questionnaire was administered by the researcher to the respondents while the observation checklist was directly used by the researcher to seek information on actual integration of ICT in the classroom and the resources that were being used.

3.9 Data analysis techniques

Analysis of data started with verifying raw data for accuracy and completeness. The information gathered from the respondents was analyzed using descriptive statistics such as mean, mode, frequencies, and percentages. Analyzed data was presented using tables, charts and graphical distribution in accordance with the respective study objectives and research questions. Statistical Package for Social Sciences (SPSS) computer package will be used for data analysis.

Qualitative data from open ended questions was thematically presented in narrative form where possible. Explanations on the status of the various variables in the study were analyzed and responses presented in terms of percentages.

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS, INTERPRETATION AND DISCUSSION

4.1 Introduction

In this chapter, the findings of the data analysis of the study together with the interpretations are presented. The data were processed using SPSS. All themes discussing the same objective were analyzed and presented together. Data were presented using tables, pie charts and histograms as well as in narrative form. In line with the objectives of the study, data were analyzed under the following sub-headings questionnaire return rate, demographic information of the teachers, in-service education and training opportunities offered to teachers, attitude of teachers towards integration of ICT in science education, Level of ICT competency among science teachers, availability of ICT resources, and a summary of the findings in the chapter.

4.2 Questionnaire return rate

Return rate is the proportion of the population that participated as intended in the research procedures. In this study, 85 science teachers were targeted and 85 questionnaires were distributed to the teachers in Molo district. A total of 76 questionnaires were received back that constituted 90.33% return rate.

4.3 Demographic information of the teachers

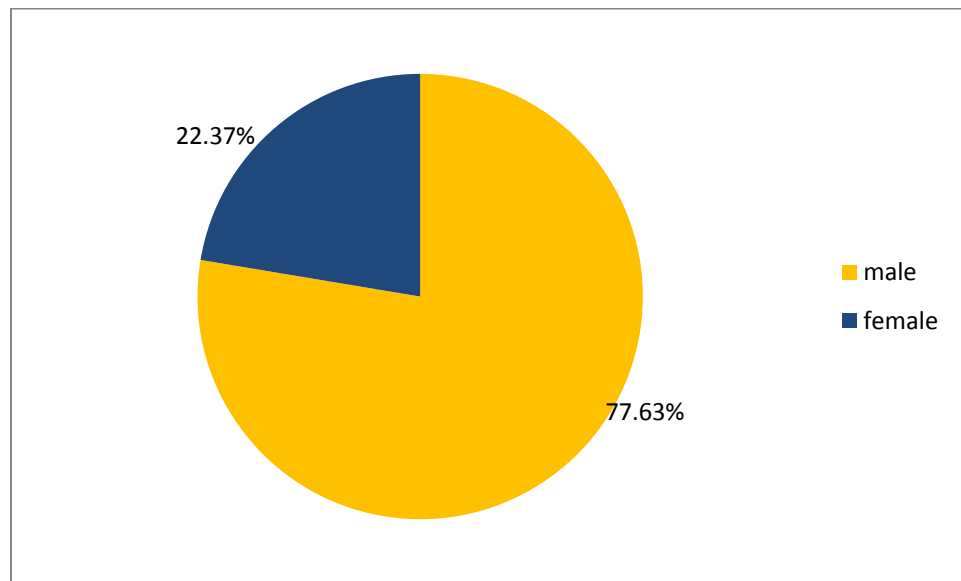
The demographic information that was corrected about the science teachers was based on gender, age, qualification, workload, professional experience, school's enrolment and the number of science teachers in the school. This was meant to provide basic information about the respondents and assess their initial abilities and suitability in the study.

4.3.1 Gender of the science teachers

To establish the gender of the respondents, the science teachers were asked to indicate this on the questionnaire. Data on the gender of the respondents was as shown in figure 4.1

Figure 4.1

A pie chart showing the distribution of the respondents by gender.



From the data obtained on the distribution of science teachers by gender, it was established that 78% were male while 22% and were female. These findings show a large gender disparity in the distribution of science teachers in the district.

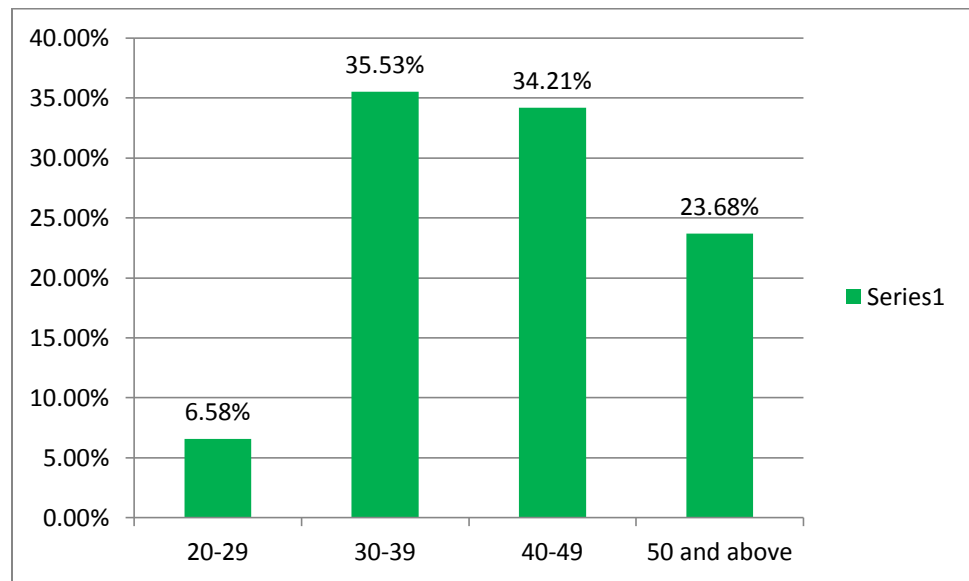
4.3.2 Age of the science teachers

The studies also sought to establish the distribution of the respondents by age.

This distribution is shown in figure 4.2

Figure 4.2

Distribution of the science teachers by age in years



From the figure 4.2, 7% of the science teachers were aged between 20-29 years, 36% were aged between 30-39 years, 34% were aged between 40-49 years and the rest 24% were aged 50 years or older. This showed that there were more science teachers in the older age brackets than the young one hence could not readily adopt integration of ICT in teaching and learning process.

4.3.3 Work experience of the science teachers

The respondents were further asked to indicate the duration of time that they had been working as science teachers. Table 4.1 presents this data

Table 4.1

Teaching experience of the science teachers in years

Duration (years)	f	%
0-3	6	8
4-10	21	28
10 and above	49	64
Total	75	100

The data indicated that 8 % had been in school for a period of less than 3 years, 28% had been teaching science for a period between 4-10 years and 64% had served for 10 years or more. The data showed that most of the science teachers had served for a considerably long time and hence expected to have useful information above integration of ICT in the teaching and learning of science education.

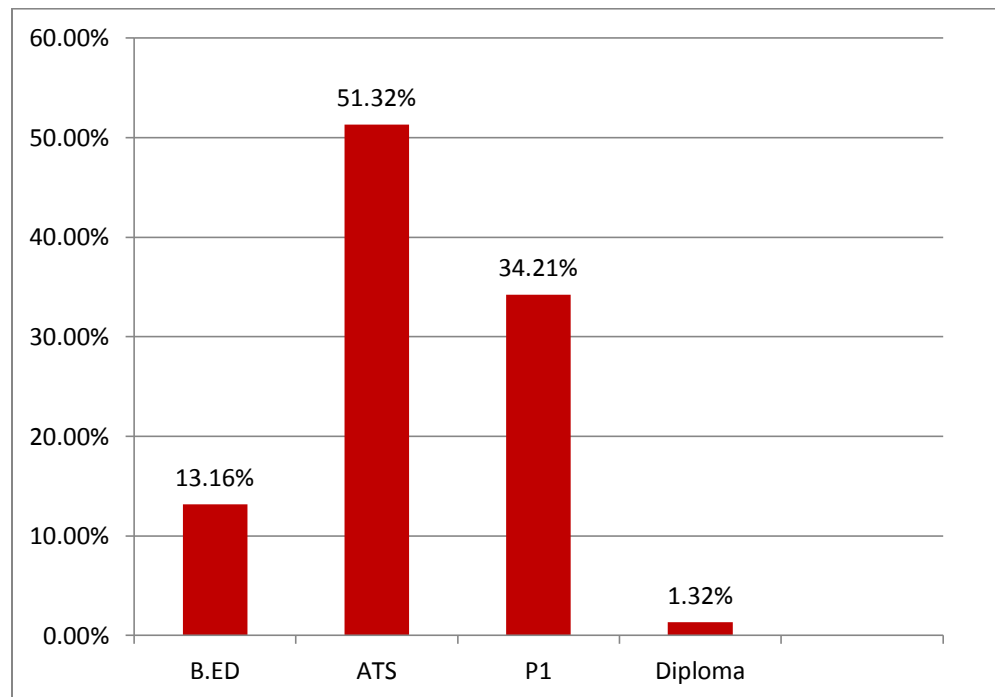
4.3.4 Professional qualification of teachers

The study also sought to find out the actual qualifications of the science teachers.

This data was presented figure 4. 3.

Figure 4.3

Professional qualifications of the science teachers



The data on qualification of the science teachers indicated that 13% had bachelor of education degree, 51% were in ATS scale, 1% had a diploma in education while the rest 35% and were P1. These findings indicate that all of the science teachers were qualified as teachers but it was not clear whether they could be capable of providing the expected information on integration of ICT in science education.

4.3.5 The number of science teachers in a school

The respondents were asked to provide data on the number of science teachers.

Table 4.3 below represents the summary of that data.

Table 4.2

Number science teachers per school

Number of science teachers	f	%
1-3	16	21
4-6	22	29
7-9	17	23
10-12	17	22
13-15	4	5
Total	76	100

From the table above, 21% of the science teachers reported that their schools had 1-3 science teachers 29% had 4-6, 23% had had 7-9 science teachers, and 22% had 10-12 science teachers. From this data, it can be deduced that most of the schools were fairly were staffed with teachers who were actively teaching the science content in the primary schools.

4.3.6 Teaching workload per week

Finally, the respondents were asked to provide data on their total workload per week. Table 4.4 below was used to present this data.

Table 4.3

Number lessons per week for science teachers

Number of lessons per week	f	%
Less than 20	4	5
20-29	25	33
30-39	34	45
40 and above	13	17
Total	76	100

From the table above, 5% of the teachers had a weekly workload of less than 20 lessons, 33% had 20-29 lessons, 45% had 30-39 lessons, while the rest, 17% had more than 40 lessons per week. This showed that majority of the science teachers had a heavy workload, with an average of over six lessons per day. This left little time for lesson preparation and other curricular activities.

4.4 In-service education and training opportunities offered to teachers

The study sought to establish the factors that influence integration of ICT in primary school science education in Molo district. To do this, the role played by

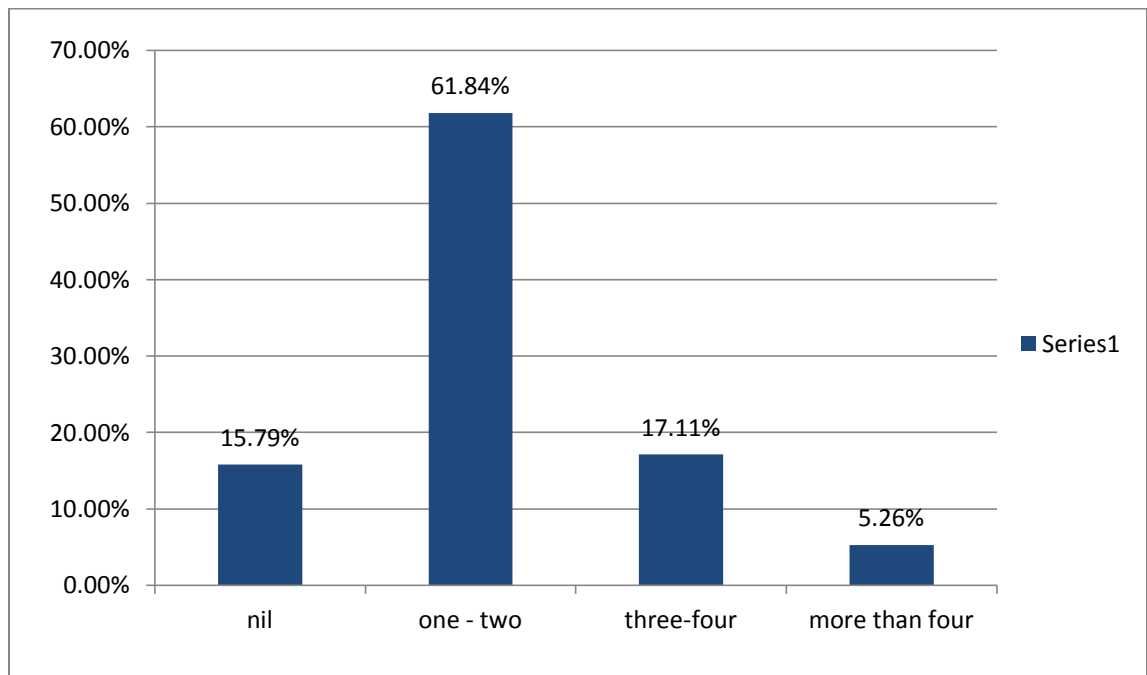
in-service education and training offered to teachers was investigated. In-service education and training is important because it provides for continuous improvement in the quality of services through continuous skills upgrading for teachers. The rationale is to address past weaknesses of practicing teachers by giving them skills beyond those acquired during pre-service training.

4.4.1 Number of INSETs science teachers had attended in the past 2 years

First, Science teachers were asked to indicate the number of in-service education and training (INSET) seminars or workshops organized by the Ministry of Education (or Quality Assurance and Standards Department) they have attended in the past two years. The responses were as shown in figure 4.4

Figure 4.4

Number of INSETs science teachers had attended in the past 2 years



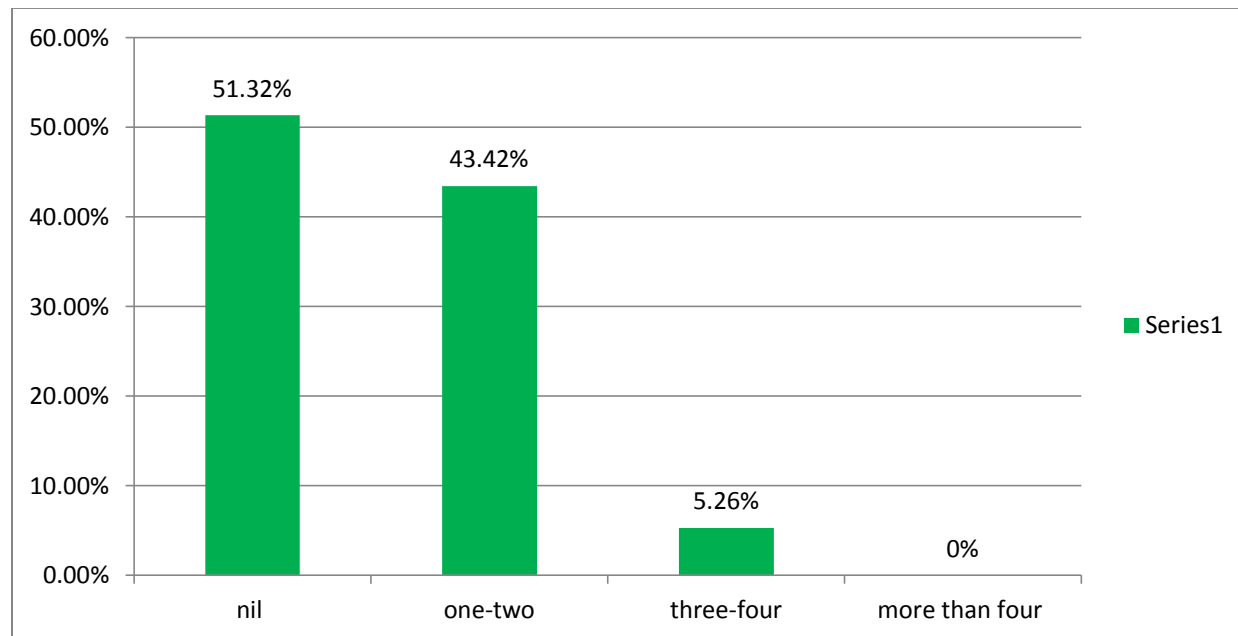
From this data, only 16% of all the science teachers reported not to have attended a capacity building workshop or seminar in the last 2 years. The rest 84% reported to have attended at least one seminar, with 5% saying they had attended more than four such seminars in the same period. It could be deduced that capacity building workshops for science teachers were being conducted and teachers were actually attending as required in Molo district.

4.4.2 Number of INSETs on integration of ICT in science education attended by science teachers

The research also sought to find out the number of the INSETs that dealt with integration of ICT in the teaching and learning process. The findings were as tabulated in the figure 4.5.

Figure 4.5

Number of INSETs on integration of ICT in science education attended by science teachers



It was observed that a large proportion of the science teachers 51.32 % had not attended a seminar or workshop related to the integration of ICT in science education. However, 48.68 % of the science teachers had attended at least a one seminar on the integration of ICT. So it could be deduced that information on the

need to integrated ICT in the teaching and learning in science education was being disseminated though at low pace that had not reached a majority of the science teachers.

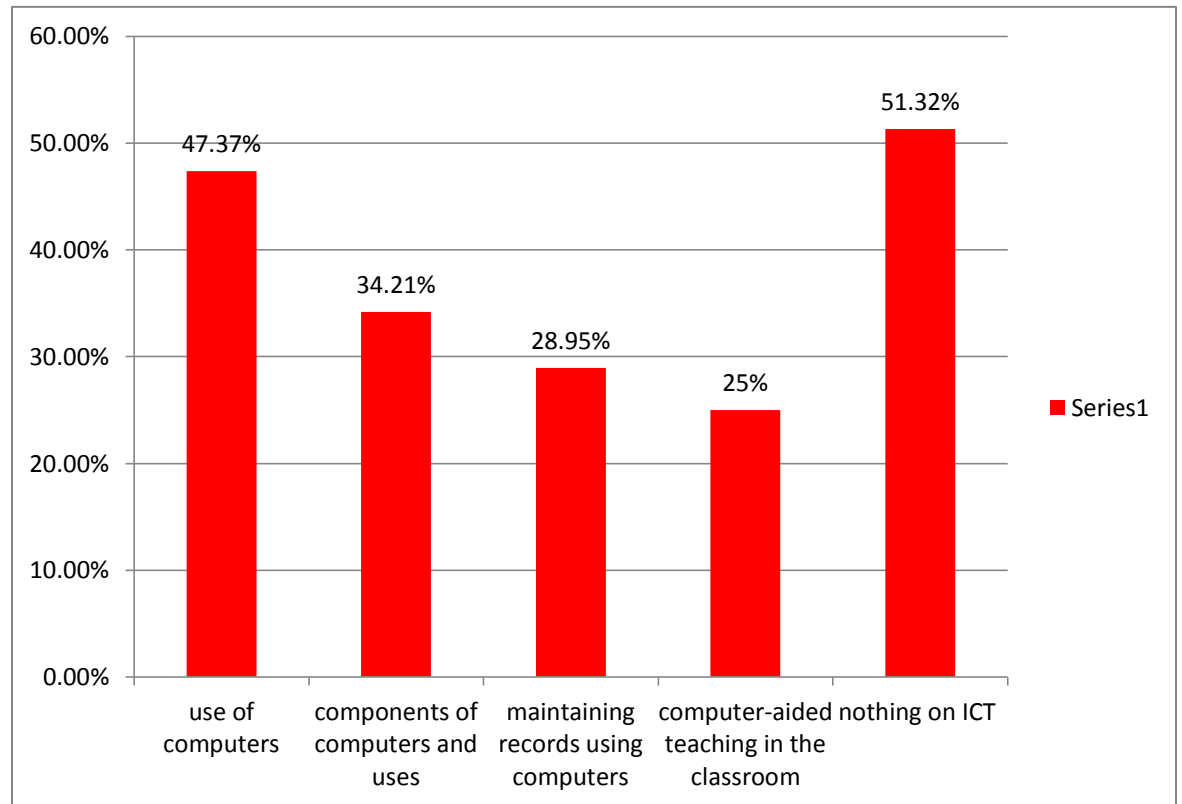
From these findings it could be deduced that most of the seminars organized for the teachers were not related to integration of ICT in science education. In addition, a large number of teachers had attended a seminar. This could be attributed to either ignorance on the part of the teacher or general lack of such seminars organized by the Ministry of Education or quality assurance and standards department.

4.4.3 Areas in integration of ICT covered during workshops or seminars attended by science teachers

The study also intended to establish the areas that were covered in the seminars referred to earlier. The data obtained was as shown in figure 4.6 .

Figure 4.6

A bar graph showing areas in integration of ICT covered during workshops



For those teachers who reported to have attended some seminars or workshops related to the integration of ICT in science education, 47.37% covered the use of computers, 34.21% had discussed components of a computer, 28.95% had covered the use of computers in maintaining records, while only 25% had discussed computer-aided teaching in the classroom. However, 51.32% reported not to have covered any area on integration of ICT in the teaching and learning of science education.

4.4.4 ICT resources used during workshops or seminars attended by science teachers

The researcher also wanted to establish the resources used during the workshop and seminars attended by science teachers. The data obtained was summarized in the table 4.5.

Table 4.4

ICT resources used during workshops			
ICT resource	f	%	
Computer	41	54	
Video	19	25	
Projector	37	49	
Slides	9	12	
Camera	3	4	
Flash discs	23	30	
Scanner	9	12	
None	29	38	
Total	N=76		

The data showed that in 54% of the seminars or workshops attended by the science teachers a computer was used. The use of projectors was reported by 49% of the respondents. 30% reported that flash discs were used in the workshop or seminar. About 25% reported the use of a video in the workshop while almost the same proportion reported to have used a camera, scanner, or slides. 38% reported that none of the ICT resources was used in the workshop they had attended. This showed that in most workshops or seminars, at least a computer was used but other ICT resources were not widely used. In addition, there were a large number of seminars where none of the ICT resources was used. This denied the teachers a much needed opportunity to observe how various resources could be integrated in the teaching and learning process.

4.4.5 ICT resources that could have been used in workshops or seminars

The researcher sought the opinion of the teachers on other resources they thought could have been used to make the workshop or seminar more effective. Most teachers suggested that more computers, projectors, cameras, scanners, flash discs, CDs, and video could have been also have been used to make the workshop more successful in realizing its intended objectives.

4.4.6 Areas science teachers needed to train in

Further, the researcher sought opinion of the teachers on areas they felt need to train in. Most of the teachers expressed the need to be trained in computer literacy, and how to use a computer to support the actual teaching and learning of science in the classroom.

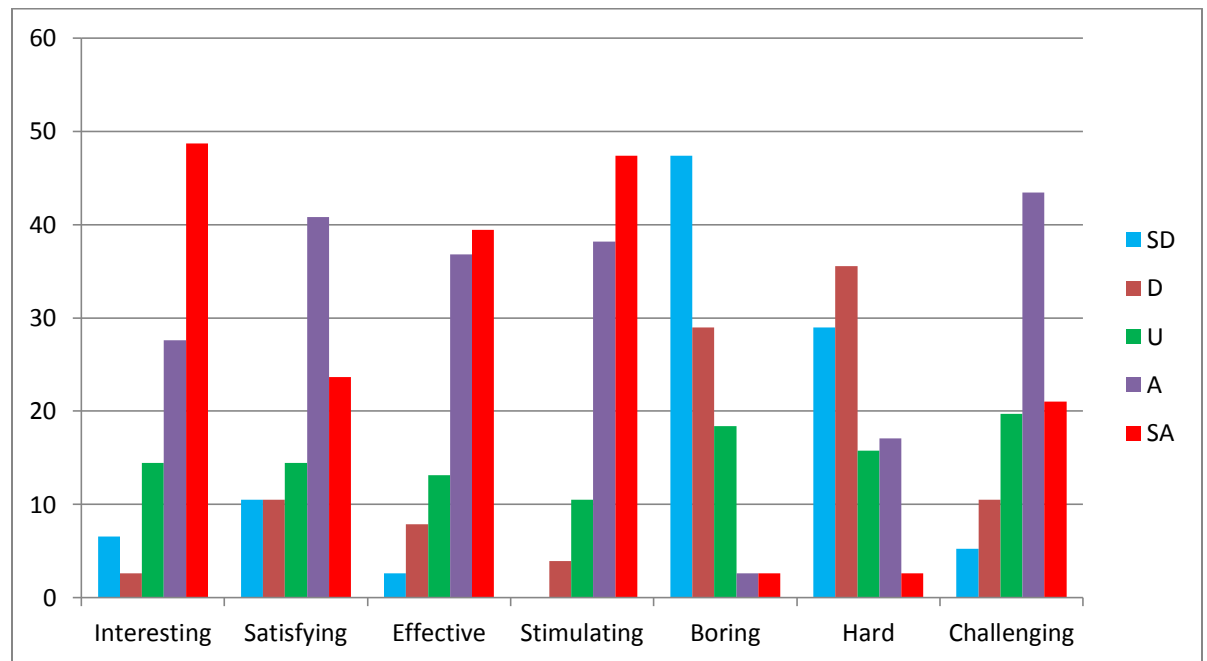
According to a study by Bundi (2012), the quality of education is heavily dependent of the quality of staff, their motivation and the leadership they experience. The quality of teaching depends on the quality of the teachers, which in turn depends to some extent on the quality of their professional development. The findings were in line with the provisions of the Sessional Paper No 1 of 2005 “A Policy Framework for Education, Training and Research” that has a comprehensive focus for teacher development and utilization under which the in-service training of teachers is a priority area. The policy articulates the need for continuous improvement in the quality of services through continuous skills upgrading for teachers. The rationale is to address past weaknesses of practicing teachers by giving them skills beyond those acquired during pre-service training.

4.5 Attitude of teachers towards integration of ICT in science education

The researcher assessed the attitude of teachers towards integration of ICT by asking them to respond to some selected questions on a five point likert scale, where SD=strongly agree, A=agree, U=undecided, D=disagree, and SD=strongly disagree. The summary of the responses was as shown in the following figure 4.7.

Figure 4.7

Attitude of teachers towards integration of ICT in science education



From the graph, it was evident that teachers believed that integrating ICT in the teaching and learning process was interesting. About 75% of the teachers agreed or strongly agreed that the integration of ICT in the teaching and learning process was:- interesting, 65% of the teachers agreed or strongly agreed that it was satisfying, 76% of the teachers agreed or strongly agreed that it was effective and 86% of the teachers agreed or strongly agreed that it was stimulating. In contrast, 76% of the teachers disagreed or strongly disagreed that the integration of ICT was boring, 64% of the teachers disagreed or strongly disagreed that it was hard,

and only 16% of the teachers disagreed or strongly disagreed that it was challenging.. They also felt that it was not boring or hard but it was challenging in terms of knowledge and skills required as well as the time required for effective preparation.

The positive attitude portrayed by the teachers in the integration of ICT in science education is a good starting point in the implementation of this recent innovation. According to Eteokleous (2008) the user's acceptance is considered an important element in the successful implementation of technology in the instructional setting, and which is greatly influenced by the users' attitudes towards technology. Moreover, Teo (2008) believes that attitudes towards computers and trust in using them in education are two major predictors for teachers' future use of technology in classrooms. Levin and Wadmany (2007) emphasize the importance of a clear focus on teachers' attitudes, values, and beliefs as a primary focus in supporting learning.

4.6 Level of ICT competency among science teachers

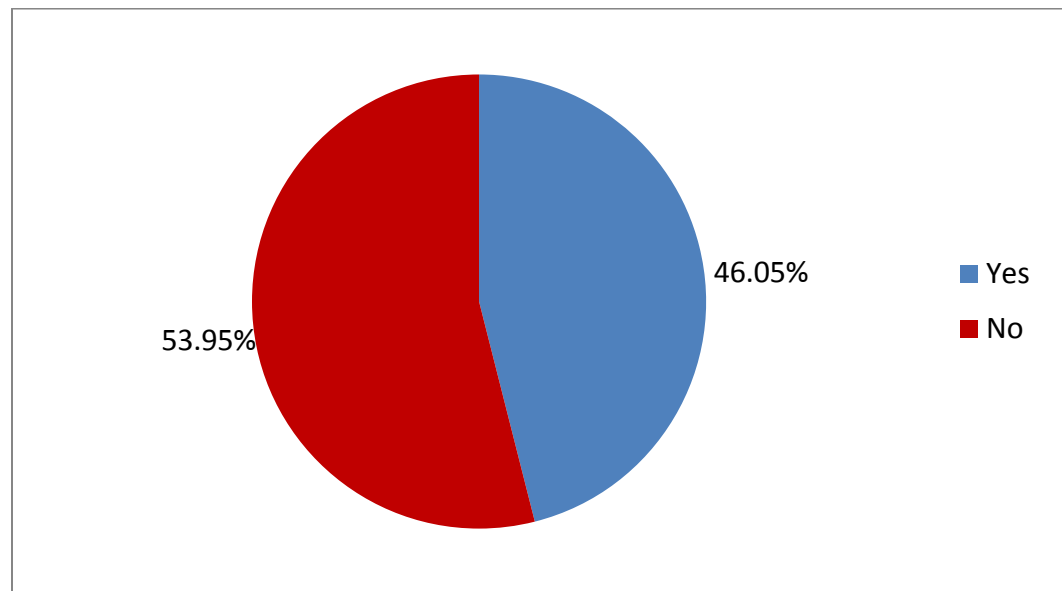
In this area, the researcher assessed the qualifications of the teachers that were related to ICT.

4.6.1 Qualifications of teachers related to ICT

Firstly, the study sought to establish the qualification of teachers that were related to the integration of ICT. Figure 4.8 shows the percentage distribution of the respondents

Figure 4.8

Qualifications of teachers related to ICT



The data showed that 46% of all the science teachers had some qualification related to ICT. However, majority of them, 54% did not have any qualification related to ICT. 29% had qualifications that were certified by Kenya National Examinations Council, while 12% had their qualification certified by a university senate. The rest had gained some competency based on other colleges that offered their own certification that were not widely recognized.

4.6.2 ICT services frequently used by science teachers

The researcher also assessed the frequency with which the science teachers used various ICT services. This data is as shown in Table 4.6.

Table 4.5**ICT services frequently used by science teachers**

Item	Frequency of response			
	Very often	Often	Rarely	Not at all
Preparation of professional records	20	9	13	34
Email	20	18	8	30
Internet search for materials	17	19	15	25
Power-point presentations	12	4	10	49
Video	20	5	8	43
Graphical illustrations	12	4	13	47

From the responses, it could be deduced that majority of the science teachers did not use the specified ICT services at all. However, 38% of the science teachers often or very often used ICT services in preparation of professional documents, email and video while 47% of the science teachers often or very often used internet to search for materials. This showed that despite majority of the teachers not using ICT services at all, many of them had the potential to embrace integration of ICT in the teaching of science education.

4.6.3 Opinion of teachers on what needed to be done to improve their competency

To capture the feelings of the science teachers, the researcher sought their opinion on what needed to be done improve their competency in the integration of ICT in the teaching of science education in their schools. Majority of the respondents said that they needed to be trained specifically on how to operate a computer, its devices and accessories, integration of ICT in the teaching and learning process, and the use of the internet to access teaching and learning materials. The teachers also suggested that they needed to be equipped with enough knowledge and skills on ICT integration besides being furnished with a curriculum on how to carry out ICT integration in science education. In addition, they said there needed to be developed a clear policy on this new area of curriculum innovation and if it was there, it had not been effectively communicated to them.

4.6.4 Challenges faced by science teachers during integration of ICT in science education

In addition, the researcher, wanted to identify the challenges the science teachers were experiencing while undertaking their teaching. Majority of the teachers reported that they lacked enough knowledge and skills on ICT integration besides lack of a curriculum on how to carry out ICT integration in science education.

4.6.5 Integration of ICT during a live lesson

To further ascertain the effectiveness of the science teachers in the integration of ICT in the teaching and learning in the classrooms, 25 live lessons were observed.

The researcher found that there was little that was being done in this area. 92% of the teachers observed did not embrace integration of ICT in the lesson preparation and presentation. It was only in 2 lessons (8%) where reference was made of a real pictures or sceneries that could be observed in the computer in the school's computer laboratory. The researcher established that there was little integration on ICT in the teaching and learning process, even where a reasonable investment had been made to put up basic infrastructure.

4.6.6 Pupils competence in the use of ICT resources

To further ascertain the effectiveness of integration of ICT in the teaching and learning process, pupils were randomly selected and their ability to use ICT resources will be assessed by the researcher. One pupil was selected in the school a lesson was observed to provide information required in this section of the study. Majority of the pupils (88%) did not have basic knowledge of computer components, did not know how to use key board and mouse. The rest 12% had some basic literacy about computers. They knew most parts, could use key board and mouse and could process some word. However, they could not use the computer to access important information or learning materials. These results supported earlier findings that integration of ICT was not being effectively carried out in the teaching and learning process in science education.

In Kenya, the Ministry of Education's ICT operational plan recognizes that integration of ICT into education is based on addressing issues of content, access,

competency, and the actual integration of ICT into teaching and learning, which is intricately tied with teacher and student competencies in the available technologies (MOE, 2006).

4.7 Availability of ICT resources

The study further sought to establish the availability of teaching and learning resources that could be used in the integration of ICT in the actual classroom activities.

4.7.1 ICT resources available in the schools

Firstly, the researcher sought to establish the ICT resources that were available in schools. Table 4.6 illustrates the resources available in schools, as was reported by the teachers and confirmed using the observation checklist.

Table 4.6**ICT resources available in the schools**

ICT qualification	f	%
Computer	26	34
Video	0	0
Projector	8	11
Slides	2	3
Camera	3	4
Flash discs/CDs	7	9
Scanner	6	8
None of the above	48	63
Total	76	100

From the data obtained, 34% of the respondents said that they had at least a computer in school. 11% or less of the respondents said that they had another ICT resource besides the computer. 63% of all the respondents said that they did not have any ICT resource within their schools. This shows the slow pace at which schools are embracing ICT and providing the necessary equipments and accessories.

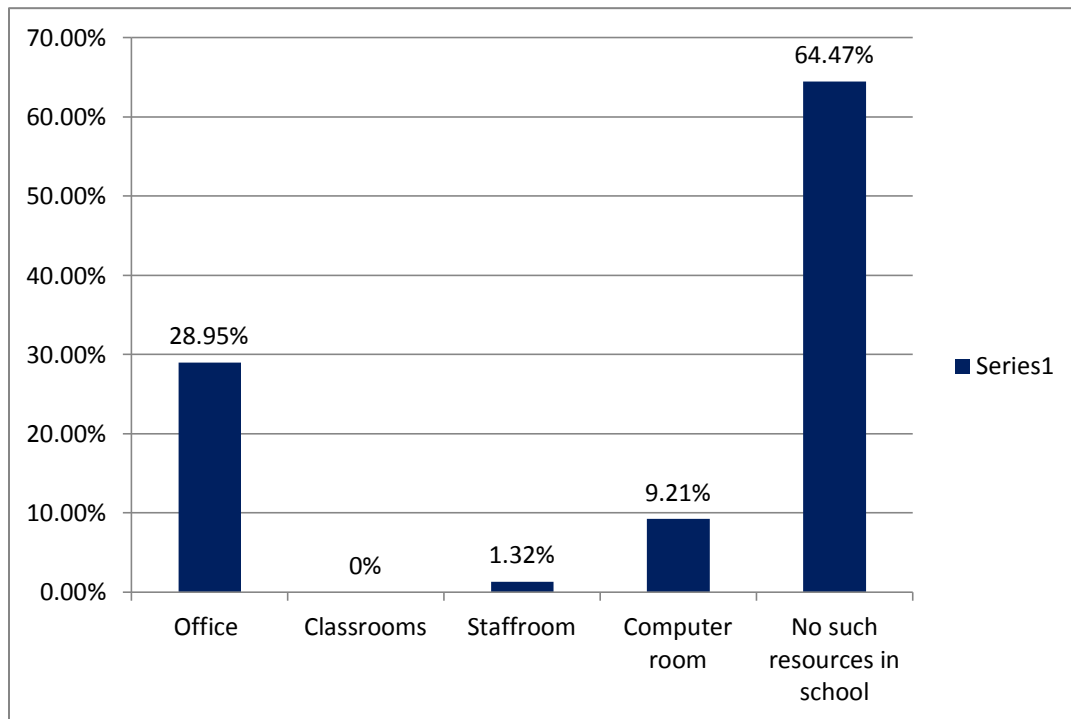
4.7.2 Location of ICT resources in the school

The study also sought to find out exactly where in the school the ICT resources were situated with a view of assessing their accessibility for integration of ICT.

Figure 4.9 presents this data.

Figure 4.9

Location of ICT resources in the school



From the table, above, 29% of those schools with ICT resources kept them in the office, 1% had placed them in the staffroom, 9% had computer laboratories where all ICT related materials were used and maintained. It was also worth noting that majority, 64% reported that they did not have any such ICT resources in their schools. It can be deduced that some schools had made significant effort to

provide ICT resources and at the same time to access them to the teachers. However majority were yet to acquire any ICT resources.

4.7.3 Condition of ICT resources available in the schools

The study also assessed the condition of the ICT resources in the schools. Table 4.7 below shows the working condition of various resources in found in the schools

Table 4.7

Condition of ICT resources available in the schools

Item	Frequency of responses			
	computers	Projectors	Cameras	scanners
Functional	166	6	2	4
Non-functional	15	0	0	0
Total	181	6	2	4

The data shows that most of the ICT resources available in schools were functional. 92% of all the computers, all projectors, cameras and scanners available in schools were functional. This showed that these ICT resources were properly maintained and were in a usable state.

4.7.4 Opinion of teachers on ICT resources required in schools

The researcher also sought to establish the ICT resources the teachers felt needed to be provided in the schools for effective integration of ICT in the teaching and learning process. In response, the teachers suggested that they needed to be provided with enough computers, projectors, cameras, scanners, flash disc, CD and smart boards. They suggested that schools be provided with a source of electric power such as solar panels or being connected to the national power grid.

4.7.5 Teachers' opinion on what need to be done for successful integration of ICT

To ensure successful integration of ICT the researcher sought the opinion of the science teachers on what ought to be done. The teachers proposed that internet connection in schools be enhanced by ensuring that the schools are adequately covered by the national internet service providers. Since ICT resources are expensive, the teachers suggested that security of the items should be enhanced. They suggested construction of computer rooms in all schools whose doors, windows and roofs are reinforced. This could go a long way in ensuring the success of ICT integration in the schools.

According to Granger, et al, (2002) teachers can neither teach computer skills nor integrate ICT into curricula without having at their disposal computers that work.

Clearly, a lack of appropriate material resources inhibits learning and causes frustration and resistance in school communities. Further, appropriate full-time technical support and significant opportunities for teacher education in the integration of ICT in the teaching and learning process are necessary if teachers are to move toward curricular integration and meaning making

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the summary of the findings, conclusions, recommendations and suggestions for further research.

5.2 Summary of the study

The purpose of the study was to investigate factors that influence integration of ICT in primary schools science education in Molo district. Four research questions were formulated to guide the study. In the first question, the study sought to find out the extent to which in-service education training opportunities provided to teachers affect integration of ICT in primary school science education. The question aimed at establishing how capacity-building activities had been carried out to equip the teachers with the relevant knowledge, skills and attitude to effectively and efficiently implement the innovation. The second question aimed at establishing the extent to which attitudes of the teachers affected integration of ICT in primary schools science education. Research question three aimed at establishing the extent to which the level of ICT competency among teachers affected integration of ICT in primary schools science education. Finally, the last question sought to determine the extent to which the availability of ICT resources affected integration of ICT in primary schools science education.

The study adopted a survey research approach. It targeted all the science teachers in public primary schools in Molo district. The sample comprised 85 science teachers. Questionnaires and a checklist were used to collect data from the respondents. The data obtained was analysed and presented in form of tables, graphs and pie charts.

In-service education and training opportunities for science teachers were being offered as confirmed by 48.68% of the respondents. The opportunities offered so far had not reached 51.32% of all the science teachers in the district. This meant that many teachers were not conversant with their roles in the integration of ICT in primary science education. The study also established those teachers who had attended some seminars on ICT were able to carry out activities related to integration of ICT.

Findings also revealed that the science teachers had a positive attitude towards integration of ICT in the teaching and learning process of science education. Over 75% of the teachers agreed or strongly agreed that the integration of ICT in the teaching and learning process was:- interesting, 64.47% was satisfying, 76.32% was effective and 85.53% was stimulating. In addition, 76.32% disagreed or strongly disagreed that the integration of ICT was:- boring, 64.47% was hard, and

only 15.79% was challenging. So 84.21% believed that the process of integrating ICT in science education was challenging in terms of knowledge and skills required as well as the time required for effective preparation.

The researcher also found out that more than half that is 53.95 % of all the primary school science teachers did not have any qualification on ICT. It was also established that majority of the teachers did not use those services related to ICT integration such as preparation of professional records, email, internet search for materials, power-point presentations, video as a teaching aid and graphical illustrations. However, over 40% of the teachers had some qualification certified by Kenya national examinations council or a university senate. This group of teachers frequently used some services related to the integration of ICT in the learning process.

The researcher further established that the ICT resources available in our schools were inadequate. The number of computers, projectors, cameras, scanners, video, flash discs or CDs were not enough. 63.16% of all the respondents said that they did not have any ICT resource within their schools, while 10.52% or less of the respondents said that they had another ICT resource besides the computer. Of those schools that were found to have had ICT resources, 28.95% of them kept the resources in the office, 1.32% had placed them in the staffroom, 9.21% had

computer laboratories where all ICT related materials were used and maintained. Approximately 91.71% of all the computers, all projectors, cameras and scanners available in schools were functional.

Besides provision of adequate ICT resources, the study also found out that there was need for schools to be provided with a source of electric power such as solar panels or being connected to the national power grid. In addition, it was necessary to provide for internet connection in schools by ensuring that they are adequately covered by the national internet service providers.

5.3 Conclusions

Based on the findings, the researcher concluded that availability of in-service education and training opportunities for teachers affect integration of ICT in primary schools science education in Molo District. Those who had attended some ICT related workshops or seminars were more proficient than those who had not attended any such workshop or seminar. It was also concluded that the attitudes of the teachers affected integration of ICT in primary schools science education. Teachers generally had a positive attitude about it, but felt it would be more challenging since it would require more time for preparation and a certain level of knowledge and skills in the field of ICT, that majority did not have. Also, it was concluded that the level of ICT competency among teachers affected integration of ICT in primary schools science education. Majority of them did not

have the basic knowledge and skills to enable to effectively conduct integration of ICT in the classroom. Finally it was concluded that the availability of ICT resources affected integration of ICT in primary schools science education. Majority of public primary schools lacked ICT resources. Other support services such as availability of electric power, internet connectivity, and security were other impediments that hinder effective integration of ICT in science education.

So, the researcher established that factors such as in-service education and training opportunities offered to teachers, teachers' attitudes, competency, and availability of ICT resources affected integration of ICT in science education.

5.4 Recommendations

The study made the following recommendations, based on the findings

- i. That in-service education and training opportunities for teachers in the integration of ICT in primary schools science education should be intensified with a view of reaching all the science teachers in public primary schools. This should be done by the Education Standards and Quality Assurance Council in consultation with the Teachers Service Commission.
- ii. That attendance of in-service seminars related to ICT integration be made a prerequisite for promotion so that the science teachers take it seriously. This should be done by the Teachers Service Commission.

- iii. The positive attitude of science teachers towards integration of ICT in education should be harnessed by offering the teachers appropriate knowledge and skills to enable them deliver on this curriculum innovation.
- iv. Training and capacity building activities on integration of ICT in science education should be provided for all teachers to ensure that they were competent enough to implement this innovation. This should be done by the Education Standards and Quality Assurance Council in consultation with the Teachers Service Commission.
- v. That the policy on integration of ICT in the teaching and learning should be effectively communicated to the schools and teachers in general to enhance its effective and efficient implementation. This should be done by the Education Standards and Quality Assurance Council in collaboration with the Teachers Service Commission.
- vi. Adequate ICT resources should be provided to all schools. In addition, support services such as internet connectivity, electric power, and security needed to be assured for all schools. This should be done by the Ministry of Education in consultation with the Teachers Service Commission.

5.5 Suggestion for further research

Based on the findings of the study, the following areas were suggested for further research

- i. A similar study could be conducted on other subjects besides science education in primary schools to establish factors that influence integration of ICT in the teaching and learning process of the subject.
- ii. A comparative study could be done between the level of integration of ICT public and private primary schools.

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APPENDICES

APPENDIX A

LETTER OF INTRODUCTION

University of Nairobi

School of Education

Department of Education Administration and Planning

P O Box 30197

Nairobi

To : All Headteachers

Molo District Public Primary Schools

**Re: RESEARCH PROJECT ON FACTORS THAT INFLUENCE
INTEGRATION OF ICT IN PRIMARY SCHOOL SCIENCE
EDUCATION**

I'm pleased to inform you that I'm a Master of Education student in the University of Nairobi carrying out a study on "**factors influencing integration of ICT in primary school science education in Molo District**". I seek your authority to administer the attached questionnaire to science teachers in your school. I also seek your assistance in ensuring that the questionnaire is filled. The responses will be used for the purpose of this study only.

Your assistance will be highly appreciated.

Yours faithfully,

Joshua K Kaga

Research Student

APPENDIX B

SCIENCE TEACHERS' QUESTIONNAIRE

This questionnaire seeks to collect information on factors that influence integration of ICT in primary science education in Molo District. The information collected will be used for academic purpose only and your identity will be treated with confidentiality.

Section A: Demographic Data

a) Kindly fill this questionnaire by putting a tick in the appropriate box or by filling in your response in the provided spaces

b) What is your Gender? : Male Female

c) What is your age bracket (years)? [20-29] [30-39] [40-49] [50 & above]

d) For how long have you taught? [0-3 yrs] [3-10 yrs] [10 yrs or more]

e) What is your current professional qualification?

BED P1 ATS

Unqualified

Any other (specify)_____

f) What is the enrolment of your school?_____

No. of boys_____ No. of girls_____

g) How many science teachers are there in the school?_____

h) What is your weekly workload(total number of lessons)?_____

Section B: In-service education and training opportunities offered to teachers

2 a) In the last 2 years how many in-service education and training (INSET) seminars or workshops organized by the Ministry of Education (or quality Assurance and Standards Department) have you attended?

Nil one-two three-four more than four

b) Of the INSETs you attended, how many dealt with integration of ICT in the teaching and learning process? Nil one-two three-four more than four

c) During the seminars or workshops, which of these areas were covered? (tick as many as possible from the list below)

- Use of computers
- Components of a computer and its user devices
- Maintaining records using a computer
- Computer-aided teaching in the classroom
- Any other (specify)_____

d) During the workshop/ seminar, what ICT resources were used? Tick as many as possible from the list below.

- Computer video Projector
- slides
- Camera flashdiscs/CDs Scanner

e) What else do you think could have been used to make the workshop/seminar more successful?

f) What areas might you want to be trained on in ICT?

SECTION C: Attitude of teachers towards integration of ICT in science education

3 Use the key provided to respond to the statements below.

Key : SD=strongly disagree D=disagree U=undecided A=agree SA = strongly agree Teaching science course with the use of ICT resources is:-

S/no		SD	D	U	A	SA
a)	Interesting					
b)	Satisfying					
c)	Effective					
d)	Stimulating					
e)	Boring					
f)	Hard					
g)	Challenging					

Section D: Level of ICT competency among science teachers

4 a) Do you have any qualification related to ICT? Tick as appropriate.

Yes No

b) If, yes what level? Degree Diploma
Certificate

c) Which examination body offered you the qualification?

KNEC University senate

Others (specify)_____

d) How often do you use the following ICT services? Tick as appropriate

	Very often	Often	Rarely	Not at all
Preparation of professional records				
Email				
Internet search for materials				
Powerpoint presentations				
Video				
Graphical illustrations				

e) Suggest ways in which your competency in integration of ICT can be improved

f) What challenges do you face when using ICT?

Section E: availability of ICT resources

5 a) Which ICT resources are available in your school? Tick as many as possible.

Computer video Projector slides
 Camera flashdiscs/CDs Scanner

b) Where in the school are these resources available? Tick as appropriate.

office Classrooms Staffroom Computer room

c) How many of these ICT resources are available in your school how many are functional?

	computers	Projectors	Cameras	scanners
Functional				
Non-functional				
Total				

d) What ICT resources would you wish provided for your teaching?

e) In your opinion, what needs to be done to ensure successful integration of ICT in the teaching of science education?

APPENDIX C

OBSERVATION CHECKLIST

This observation checklist seeks to collect information on factors that influence integration of ICT in primary science education in Molo District. The information collected will be collected from the head-teachers and will be used for academic purpose only.

- 1) The table below will be used to capture the quantity and status of specified ICT resources in the school

	Type of ICT resource	Quantity	Where located	Working Status
1)	Computer			
2)	Printer			
3)	Scanner			
4)	Projector			
5)	Camera			

- 2) A live science lesson will be observed and integration of ICT will be assessed to complete the following section
- i. Lesson preparation.....
 - ii. Delivery method.....
 - iii. Use of ICT resources.....
 - iv. Effectiveness of the resources.....
- 3) Pupils will be randomly selected and their ability to use ICT resources will be assessed. The information will be used to fill the following section
- i. Knowledge of computer components.....
 - ii. Ability to use key board, mouse.....

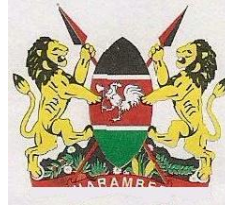
- iii. Ability to process words.....
- iv. Ability to access some information from a computer.....

End

APPENDIX D

RESEARCH AUTHORIZATION

REPUBLIC OF KENYA



NATIONAL COUNCIL FOR SCIENCE AND TECHNOLOGY

Telephone: 254-020-2213471, 2241349, 254-020-2673550

P.O. Box 30623-NM NN
Mobile: 0713 788 787, 0735 404 245
NAIROBI KEN A
Fax: 254-020-2213215
Website: www.ncst.go.ke
When replying please quote
secretary@ncst.go.ke

our Ref: NCST/RCD/14/013/707

Date: 17th May, 2013

*Joshua Kariuki Kaga
University of Nairobi
P.O Box 30197-00100
Nairobi*

RE: RESEARCH AUTHORIZATION

Following your application dated 3rd May, 2013 for authority to carry out research on "Factors influencing integration of Information Communication Technology in primary school science education

in Molo

District, Nakuru County, Kenya." *I am pleased to inform you that you have been authorized to undertake research in **Molo District** for a period ending 31st July, 2013.*

*You are advised to report to **the District Commissioner and District Education Officer, Molo District** before embarking on the research project.*

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

SAID HUSSEIN

FOR: SECRETARY/CEO

Copy to:

*The District
Commissioner
The District
Education
Officer Molo
District*

The National Council for Science and Technology Is Committed to the Promotion of Science and

Technology for National Development".

% i.

APPENDIX E

CLEARANCE TO COLLECT DATA IN MOLO DISTRICT

MINISTRY OF EDUCATION

Telegrams: "LEARNING"

District

Education Of



Telephone: 0203528112

Molo District

Fax 0202188546

P. O. Box 275

When replying please quote

MOLO

our ref : **EDM/EDU/EPS/VOL I/27**
2013

7th May

The Head-teacher;

_____ Primary School

Molo District

**RE: CLEARANCE TO COLLECT DATA FOR RESEARCH PURPOSE
ONLY IN MOLO DISTRICT**

I am pleased to inform you that Mr Joshua K Kaga, Reg No E55/62602/2011 has been authorized to collect data in your school for the purpose of a study he is undertaking.

Kindly accord him the necessary assistance

Yours faithfully,

MWAURA WANJOHI
FOR: DISTRICT EDUCATION OFFICER
MOLO DISTRICT

cc

The Chairman,
Department of Education Planning and Administration,
University of Nairobi

APPENDIX F

Public primary schools and their enrolment by gender in Molo District – 2013

S/N	Schools	Sub - total		Grand total
		B	G	
1.	St. Peters girls boarding	0	353	353
2.	Michinda boys boarding	426	0	426
3.	Mianzini	372	376	748
4.	Nyakiambi	379	366	745
5.	Mwangi Michuki	200	175	375
6.	P.C.E.A. Elburgon	673	677	1350
7.	St. Peters girls day	0	956	956
8.	Arimi	319	261	580
9.	Sokoro	366	357	723
10	Turi Sugwita	973	998	1971
11	St. Josephs	175	180	355
12	St. Peters Boys	915	0	915
13	Elburgon DEB	508	527	1035
14	St. James	250	285	535
15	St. Brendans	281	283	564

16	Mariashoni	296	332	628
17	Chandera	790	755	1545
18	Orthodox	452	507	959
19	Ndimu DEB	242	225	467
20	New Creation	433	412	845
21	Oinoptich	234	221	455
22	Sakaitim	196	206	402
23	Lawina	158	161	319
24	Mutate	262	301	563
25	St. Stephens	190	216	406
26	Rombei	287	303	590
27	Ndoswa	273	329	602
28	Timoo	244	248	492
29	Kaprop	197	208	405
30	Kimonio	223	250	473
31	Tayari	895	900	1795
32	Kapsorok	196	186	382
33	Sachangwan	137	99	236
34	St. Mary's mixed	1074	1060	2134
35	Mt. St. Mary's girls boarding	0	997	997
36	Mwangaza	87	80	167

37	Mukinyai	398	424	822
38	Moto	734	788	1522
39	Nguzu River	548	602	1150
40	Kambala	727	789	1516
41	Mona	431	427	858
42	Kiambiriria	321	286	607
43	Michatha	264	274	542
44	Tumaini	321	365	686
45	Chesingele	424	381	805
46	Kibunja	146	142	288
47	Molo Academy boarding	682	275	955
48	Rosewood	95	109	204
	Total	17,794	18,652	36,446

Source: Molo District Education Office