INTERROGATING TEACHERS' SUPPORT STRUCTURES FOR EFFECTIVE IMPLEMENTATION OF ICT IN KENYA PRIMARY SCHOOLS

by

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I declare that the above thesis is my own work and that all the sources that I have used or quoted have been indicated and acknowledged using complete references.

I further declare that I submitted the thesis to originality checking software and that it falls within the accepted requirements for originality.

I further declare that I have not previously submitted this work, or part of it, for examination at Unisa for another qualification or at any other higher education institution.

24th February 2022

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DEDICATION

This thesis is dedicated to five beloved people who have meant and continue to mean so much in my life. They include my daughter, Njeri Thuo; my son, Kimani Thuo; my husband, Anthony Thuo; my mother Wanjiru Kariuki; and lastly my father, Charles Kariuki (although no longer of this world) whose passion for life-long-learning has continued to inspire me.

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ABSTRACT

Teachers cannot do it alone!

Teachers hold the inestimable place of linking policy-makers and learners, a role that has become increasingly important in the age of integration of Information and Communication Technologies (ICTs) in education. In Kenya, as is the trend globally, the country has, for many years, been intentional in its efforts to infuse ICTs in education at all levels. In basic education, the National Education Sector Plans (NESPs) of the last two decades incorporated ICT into teaching and learning as one of its priorities. Behind these ICT-in-Education plans is the need to ensure that the teachers can support the agenda.

The purpose of this study was therefore to interrogate the existing teachers' support structures for optimal use of ICTs and identify gaps to be addressed. To achieve this, the study applied a mixed method approach which complementarily fused both qualitative and quantitative research strategies, processes and procedures. Data was collected from teachers and head-teachers drawn from public primary schools in four selected counties of Kajiado, Kilifi, Nairobi and Uasin Gishu in Kenya. The sample size was 352 respondents from a 3,400-population block from whom data was collected through questionnaires and structured interview schedules. A two-phase model was engaged with an initial process of quantitative data collection from teachers, followed by qualitative data collection using structured interviews with head-teachers which provided rich narratives to affirm and expound on teachers' feedback. Concurrently, publicly available policy documents were considered and reviewed in this study. The various quantitative and qualitative datasets were then analysed in descriptive and inferential statistical methods and subsequently triangulated to enhance the validity and credibility of the findings.

The study was anchored in two theories namely: Network Society Theory and Diffusion Innovation Theory. The interpretivist paradigm was adopted since the study was dealing with teachers who occupy a unique place in the society given that they interact with each one of us at one point or another. This research was largely informed by teachers' perceptions, attitudes and interpretations regarding the support structures provided for integration of ICTs in the teaching and learning process.

The findings indicated that in Kenya's public primary schools, the existing structures were not adequate and not effective in supporting teachers for ICT; teachers and/or head-teachers have

no clear understanding of the ICT policies in place; head-teachers appreciate the positive and significant relationship between well-defined teacher support structures and effective integration of ICT in school activities; and that while there is significant ICT infrastructure in most schools, there is insufficient technical support to teachers which leads to a poor appreciation of the power of technology to support teachers' activities in schools. The study also revealed some barriers that hinder teacher support for ICT integration which included inadequate ICT infrastructure for the teachers; poor ICT skills resulting from a low level of ICT support to teachers; and negative attitudes stemming from lack of confidence in the use of ICT devices.

The study concluded that while the barriers that prevent teachers from effectively using ICT are immense, they are not insurmountable and therefore, every effort should be sought to upskill and motivate teachers to transition to a mindset that sees ICT as an integral enabler of teaching and learning in the 21st Century. The study, therefore, recommends that education stakeholders need to re-think the structures of support to teachers by paying special attention to providing the requisite environment of both soft and hardware towards a sustainable and effective ICT-in-Education ecosystem. Some of the tangible recommendations of this study are the deployment of a framework for continuous ICT in teaching Skills and Content on-Demand (SCoD1); and re-designing ways to motivate teachers with continuous in-system incentivisation and recognition of exemplary practice.

The apogee of this study is a clarion call to shift the focus from policy to practice by instituting specific activities that will see the teachers appreciate, through practice, the astounding potential presented by ICTs. This will result in significantly reducing teachers' mundane workload so as to concentrate on their critical role of effectively facilitating teaching and learning, ultimately achieving excellent learning outcomes. It is by empowering the teachers that the education sector will exploit the optimal benefits of ICTs-in-Education, particularly in Primary Schools and Basic Education as a whole.

Keywords: ICT integration; teacher support; teaching and learning; public primary schools; Kenya.

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[1] This is a creation of this study with an intent to patent and to develop such a platform for teachers

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LIST OF ACRONYMS

ACE	Accelerating 21st Century Education
ADDIE	Analysis, Design, Development, Implementation and Evaluation
ANOVA	Analysis of Variance
CAK	Communications Authority of Kenya
CATS	Continuous Assessment Tests
CE	Century Education
CEPK	Computers in Education Project in Kenya
CFT	Competency Framework for Teachers
CSR	Corporate Social Responsibility
CUE	Commission for University Education
DLP	Digital Literacy Programme
DOI	Diffusion of Innovation
ECDE	Early Childhood Development and Education
EFA	Education for All
ICT	Information and Communication Technologies
IDRC	International Development Research Centre
INSET	In-Service Training
KCPE	Kenya Certificate of Primary Education
KCSE	Kenya Certificate of Secondary Education
KEMI	Kenya Education Management Institute
KICD	Kenya Institute of Curriculum Development
KISE	Kenya Institute of Special Education
KNEC	The Kenya National Examination Council
KUCCPS	Kenya Universities and Colleges Central Placement Service
LIS	Library and Information Science
MDGs	Millennium Development Goals
MoE	Ministry of Education
MOEST	Ministry of Education, Science and Technology
NEPAD	New Partnership for Africa Development

NEPP	National Education Policies and Programmes
NESP	National Education Sector Plan
NESSP	National Education Sector Strategic Plan
OECD	Organisation for Economic Cooperation and Development
PIRLS	Progress in International Reading Literacy Study
SP	
TIMSS	Trends in International Mathematics and Science Study
ToTs	Trainer of Trainers
TVET	Technical and Vocational Education and Training
UNCRC	United Nations Convention on the Rights of the Child
UNESCO	United Nations, Educational, Scientific & Cultural Organisation
UNISA	University of South Africa

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CHAPTER ONE

INTRODUCTION AND OVERVIEW

1.1. INTRODUCTION

The need to continuously enhance the capacity of teachers to effectively adopt and sustain their abilities to infuse ICT in delivery, monitoring and management of learning cannot be over-emphasised. The pressure of time in developing and implementing appropriate teacher support structures can make reflections on this topic seem like an insurmountable endeavour yet given the fact the teacher remains one of the most significant variables in determining the success of ICT-infused education, this should be of primary concern to any education system. ICT-in-Education for teachers must blend analytical thinking at the intersection of content and pedagogy and critical insight from work in the classroom, connected to professional knowledge within the ever-changing landscape of ICT-in-Education.

Globally, ICTs have greatly impacted on teaching and learning in schools. It has been about two decades since the first rollout of computers in schools and with this has emerged the need to restructure how the students learn and to redefine the teacher's role in the classroom. While there has been a wide consensus that ICTs, implemented optimally, have the potential to positively impact learning outcomes, some rigorously designed evaluations suggest that merely increasing the use of technologies is unlikely to result in significant improvements in learning outcomes.

This could be largely attributed to existing gaps in the digital skills of teachers in both basic skills and the related pedagogical strategies in ICT teaching and learning environments; difficulties in locating high-quality digital learning resources; lack of clarity on the changing role of teachers; and insufficient pedagogical preparation for blending technology meaningfully into lessons and curricula (Organisation for Economic Cooperation and Development (OECD), 2015). Through the decades, there has been considerable emphasis on student support for ICT-supported learning but less of the same for teachers.

The 2011 United Nations, Educational, Scientific and Cultural Organisation (UNESCO) ICT Competency Framework for teachers identifies the need for a clear vision of the role that teachers have to play in harnessing the power of ICT in the classroom, their competencies and motivation as some of the key challenges to tackle in order to optimise learning outcomes with new technologies. This research seeks to investigate the support structures that are employed to, not only train teachers on ICT-in-teaching skills, but to sustain these skills and interest for effective implementation of ICTs in all education aspects in Kenya's primary schools.

1.2. BACKGROUND OF THE STUDY

In its National Education Sector Plan: 2013-2018, one of Kenya's priorities in basic education is the integration of ICT into teaching and learning. To this effect, there are several initiatives aimed at promoting the use of ICTs in both public and private schools. Most of these initiatives have been through Public-Private Partnerships by the Government of Kenya and the Private Sector. Many others have been fragmented activities on a small scale which include companies' Corporate Social Responsibility (CSR) exercises as well as those by government organs like the Communications Authority of Kenya (CAK) which has deployed computers and networked some schools.

On a larger scale, there are a few notable initiatives which include (i) The NEPAD E-Schools Project; (ii) Accelerating 21st Century Education (ACE) project aimed at improving the quality of primary and secondary education through the effective use of ICT (Project by a partnership between the Clinton Global Initiative, Cisco, Intel, Microsoft and USAID); (iii) iMlango Project aimed at using ICTs to improve the learning outcomes of marginalised communities in a partnership between UKAID and four private firms; and (iv) The Digital Literacy Programme (DLP) by the Government of Kenya which is the most ambitious initiative as it is a country-wide endeavour.

Since teachers play a crucial role as facilitators and managers of the students' learning experiences with ICT-enhanced education, there is a need to take stock and evaluate the support available to them. Teachers' support to deploy ICTs effectively in the classroom should go beyond the initial training and address the complexity that the teaching practice presents to the in-service teachers. So far, in the case of the above initiatives in Kenya, anecdotal findings indicate that the teachers only benefit from once-off, topic-led, short-term programmes that

aim to develop specific 'instant' skills in teachers. However, teacher-preparedness for use of ICTs should be a comprehensive approach that transcends the use of basic ICT-in-Education or education in ICTs to one that includes a clear, continuous support structure for teachers at the practice level.

Perhaps the most comprehensive framework for ICT-in-Education for teachers is the 2011 UNESCO ICT Competency Framework for Teachers (CFT) which provides guidelines for planning teacher education programmes and training offerings that would prepare teachers or facilitate professional development on effective ICT pedagogy integration (UNESCO and Microsoft, 2011). This framework stipulates that it is not enough for teachers simply to have ICT competencies and be able to teach them to their students but that teachers need to be able to help the students become collaborative, problem-solving, creative learners through using ICT so that they will be effective citizens and members of the workforce.

The above-mentioned UNESCO framework addresses three aspects: (i) basic ICT skills to promote efficiency in teaching and learning; (ii) knowledge deepening to facilitate in-depth subject matter knowledge; and (iii) knowledge creation to encourage the generation of new knowledge required for more harmonious, fulfilling and prosperous societies.

1.3. THEORETICAL FRAMEWORK

The theoretical foundation of this study is based on two theories: The Network Society Theory and Diffusion Innovation Theory.

1.3.1. Network Society Theory

The Network Society Theory places emphasis on the role of new technologies like ICT in schools with the aim of creating and distributing knowledge in a networked society (Stalder, 2006). According to Castells (2007:20), the various parties involved in the networked society make use of communication, computer networks and internet connectivity to create, share, distribute, and disseminate the acquired new information with the intention of being knowledgeable and enhancing the quality of individuals. This is done with the sole purpose of making the world a better place to live in for all people.

The Network Society Theory is applicable in this study since school teachers are members of the networked society who use ICT in the teaching and learning activities for the betterment of learners' future. Lack of support structures for teachers for effective integration of ICT in the education system in Kenya is a challenge that is seen through the lenses and perspective of Network Society Theory. This is through using ICT as a solution for ensuring the professional development of teachers in requisite ICT skills to enable them to disseminate the same knowledge to learners effectively.

1.3.2. Diffusion of Innovation Theory

Rogers and Shoemaker (1983) are the proponents of the Diffusion of Innovation Theory. They stated that diffusion is the process in which innovation is transmitted through established channels over time among parties of a social system. It is a special type of communication in that the messages are concerned with new ideas. Communication is a process where participants create and share information to reach a mutual understanding. Robson, Haugh and Obeng (2009:44) stated that instead of Diffusion of Innovations Theory focusing on persuading individuals to change, it sees change as being primarily about the evolution or reinvention of products and behaviours, so they become better suited to the needs of individuals and groups. In the diffusion of innovations, it is not people who change but the innovations themselves.

According to Rogers (1983), innovation is an idea, practice, or object that is perceived as new by an individual or another unit of adoption. The characteristics of innovation, as perceived by the members of a social system, determine its rate of adoption. This theory is applicable in this study since teachers' support structures in the process of ICT integration requires the assistance of ICT policy-makers at national and local school levels in innovating ICT tools that will complement the teaching methodologies applied in the classroom. This is also seen from the fact that the approach of the teachers on the ICT infrastructures is that they are innovations that create new challenges for teachers to adopt and apply in the classroom teaching. The curriculum developers thus need to incorporate this view by continuously devising strategies that will enable the teachers to embrace and adopt the new ICT teaching tools as they evolve.

1.4. RATIONALE FOR THE STUDY

Effective training and use of ICT in teaching is important since its improper use and management in the classroom may result in poor learning outcomes. It is, therefore, paramount that the teachers remain central to the learning process with the consequent shift in their role to that of a knowledge facilitator which does not obviate the need for teachers to serve as leaders in the classroom. Effective use requires not only quality teacher training but more comprehensive and continuous support for teachers. Teachers Training Programmes have tended to emphasise the initial training need, capturing a wider range of professional development models, reflecting the expanding systems of ministries of education to maximise and evaluate their impact in schools (Twining & Henry, 2014).

This study aimed at interrogating the existing teacher support structures for integration of ICT in the curriculum and consequently identify gaps. These gaps present clear pathways of support structures that would see the teacher sustain the skills and interest in ICT use, giving rise to sound pedagogy. It analysed existing ICT-in-Education support structures for teachers in Kenya Primary Schools and developed an indicative structure for improved support beyond teacher training and professional development programmes.

The study aimed at determining whether there are any impediments preventing the implementation of initiatives suggested in the National Education Sector Plan: 2013-2018 document, and, if there are, to try and build an argument around that in such a way that it forms part of the rationale for conducting the study.

1.5. PROBLEM STATEMENT

The Government of Kenya has set the integration of the ICT-in-Education curriculum as a priority in the attainment of its Vision 2030. The country has also set integration of ICT in teaching, learning and assessment in primary education as a key priority in the National Education Sector Plan: 2018-2022 (Republic of Kenya, 2018:43). Additionally, in the current government's manifesto, ICT Integration in Primary Education as contained in DLP is a key priority. Although these are noble goals advanced by the government for an ICT-focused basic education in Kenya, teachers who are tasked with the implementation of ICT integration lack

capacity and support structures for use of ICT in curriculum management (Government of Kenya, 2018:43). However, teachers' methodologies of inculcating knowledge are not ICT-based since little or no training has been undertaken to equip them with ICT-oriented skills (Tonui, Kerich & Koross, 2016:12).

Ideally, for effective integration of ICT in the teaching methodologies, teacher professional development should focus on application skills integrated into the existing curricula with requisite changes geared towards ICT-supported activities. According to Ouma, Awuor and Kyambo (2013) effective integration and implementation of e-learning require technical expertise and psychological readiness of the teacher. Tonui et al. (2016:12) stated that teachers in primary schools have inappropriate mindsets for ICT integration. They further affirmed that only 17 percent of teachers in primary schools in Kenya have received the required training for proper implementation of ICT-in-Education.

Additionally, Omariba, Ayot and Ondigi (2016:200-201) argued that primary-school teachers are incompetent in the integration of ICT in teaching methodologies, are not fully trained on the computers and other ICTs, are not computer literate, and the classrooms are not ICT-friendly to enhance ICT integration. The MOE has continuously allocated vast amounts of money to enhance ICT integration in basic education; KSh24.5 billion in 2013/2014, KSh17.5 billion in 2014/2015, KSh19.5 billion in 2015/2016 and 16.5 billion in 2016/2017 (Republic of Kenya, 2017:3-4).

Despite the colossal amount of budgetary allocation, teachers' support structures for ICT integration have largely been limited to the initial training and a few subsequent professional development programmes. An evaluation done on the success of NEPAD'S pilot e-Schools in Kenya identified gaps in support structures for teachers in ICT-in-Education and suggested that teachers' skills and knowledge needed to be enhanced. It was recommended that policies should be developed that ensure that the desired skills are incorporated in teacher in-service training and teachers should be encouraged to attend training by providing them with incentives (Nyagowa, Ocholla & Mutula, 2014:2-3). Further, the training imparted to teachers did not take into consideration the need to equip teachers with pedagogical skills that are suitable for the integration of ICT in the teaching and learning process (Nyagowa et al., 2014:2-3).

Taking cognisance of the fact that teachers are critical actors in the effective implementation of ICT in basic education, requisite support to teachers by stakeholders is paramount in enhancing ICT-enhanced teaching and learning. Effective teacher support structures will ensure a successful paradigm shift from teacher-centred to learner-centred ICT-enhanced basic education. Failure to support the teacher's acquisition of ICT skills will lead to failure in the achievement of the National Education Sector Plans and Vision 2030 and would waste the funds invested in this ambitious programmes. Based on the foregoing discussion, there was therefore a need to evaluate the existing teacher support structures that provided ICT-enhanced learning environments since these recommendations were advanced.

1.6. RESEARCH QUESTIONS AND HYPOTHESES

The research questions are defined below to set boundaries for the area to be explored while the hypotheses assumed answers to the research questions which were to be tested for accuracy. The aim was to interrogate teacher support structures for the effective implementation of ICT in Kenya primary schools.

1.6.1. Research Questions

In order to interrogate the teacher support structures for optimal use of ICT to achieve improved learning outcomes and sustain teachers skills and interest in the use of these technologies, the following research questions guided the study:

Main Question: Are existing structures sufficient to effectively support Kenya primary-school teachers with ICT integration in education?

Sub-Questions:
  i.   What are the existing teachers support structures for effective implementation of ICT in Kenya primary schools?
  ii. How effective are these teacher support structures for implementation of ICT in Kenya Primary Schools?
  iii. What are the expressed gaps in teacher support structures for ICT in the classroom environment?

iv.   How can the teachers' interest and skills in ICT use be sustained in Kenya primary schools?

1.6.2. Hypotheses

The research assumed the following hypotheses:

H_{01}. There are inadequate support structures for teachers in Kenyan primary schools to effectively implement ICTs in the education processes.

H_{02}. The current support structures for teachers in use of ICT to enhance their skills in implementation of ICT for 21st are insufficient.

H_{03}. There are significant expressed gaps in teacher support for ICT in the classroom environment.

H_{04}. There are potentially applicable strategies for sustenance of teacher interest and skills for ICT implementation in Kenya primary schools.

1.7. AIMS OF THE STUDY

It is not enough for teachers to have ICT competencies and be able to teach them to their students. Teachers need to be able to continuously use ICTs to help the learners achieve improved learning outcomes and subsequently become problem-solvers, be creative learners and eventually become effective citizens and members of the workforce (UNESCO, 2012:6). The purpose of this research was to interrogate the teacher support structures for optimal use of ICT to achieve improved learning outcomes and sustain their skills and interest in the use of these technologies as they evolve.

The study sought to fulfil the following objectives:
1. To establish existing teacher support structures for effective implementation of ICT in the Kenya primary schools.
2. To determine the sufficiency of teacher support structures for ICT in the teaching and learning process for effective implementation of ICT in the Kenya primary schools.
3. To establish gaps in teacher support needs for ICT in the classroom environment for effective implementation of ICT in the Kenya primary schools.

4. To identify potential applicable structures for sustaining teachers' interest and skills for effective implementation of ICT in the Kenya primary schools.

1.8. SIGNIFICANCE OF THE STUDY

The last few years have witnessed the investment of innumerable resources, activities and efforts in infusing the use of technologies in teaching and learning in Kenya's primary schools. This research holds significant potential for informing the various aspects of teachers' requisite support structures required to navigate this relatively new and continuously changing landscape of ICT-infused teaching and learning.

1.8.1. Ministry of Education

The findings of this study may be significant to the MOE since it will create awareness of the existing gaps in ICT support for teachers towards effective integration in the curriculum's implementation and resultant improvement in learning outcomes. The MOE would, therefore benefit, not only from a baseline from which to improve, but also the recommendations towards addressing the identified gaps.

1.8.2. Teacher Training Policies, Planning and Practice

The findings from the study will be useful to teacher training policy makers, planners and professional development programmes developers as it provides information on the strengths and weaknesses of existing teacher support structures in the integration of ICT in education. The research provides stakeholders with sufficient analysis of the existing teacher support structures and goes ahead to stipulate some necessary amendments. In effect, this research provides for an opportunity to redesign and rebuild a suitable framework for programmes to prepare and continuously support primary-school teachers in the integration of ICT in teaching and learning.

1.8.3. Future Researchers

This research may also be useful as a foundation for further studies on similar or related areas. This may include: Critical ICT skills for teachers within the new realities of a post-Pandemic

classroom; Teachers coping mechanism in the rapidly changing ICT in education landscape; ICT support structure for implementation of ICT in other sub-Saharan African Countries; etc. Such studies' findings would add knowledge to the thesis.

1.9. RESEARCH METHODOLOGY

This study is in line with the practice of social research in which science offers a special approach to the business of inquiry (Babbie, 2010). In this section, the methodology and related research design are highlighted.

1.9.1. Research Paradigm

There are two main clusters of research paradigms at play within this study: positivism/post-positivism and interpretivism. McMillan and Schumacher (2010:5) suggest that the positivism paradigm posits that studies about humans should be studied in the same way as a study of nature because scientific knowledge is regarded as facts and reality is seen as independent of social construction. Interpretivist paradigm is based on the fact that methods used to unpack knowledge related to humans and social sciences cannot be the same as its usage in physical sciences because humans interpret their world and then act based on such interpretation while the world does not (Hammersley, 2013, p. 26).

Interpretivism applied in this study with regards to seeking teachers' experiences as according to interpretivism is an approach in which individuals seek to understand their world and they develop subjective meanings of their experiences (Creswell, 2014:24). De Vos, Strydom, Fouché and Delport (2011:65) concurred and maintained that the interpretivist paradigm elicits participants' accounts of meaning, experience, or perceptions. This study was situated in the interpretivist paradigm as it was concerned with teachers' perceptions, attitudes and interpretations regarding the support structures provided to them in use of ICTs in their teaching and learning process.

1.9.2. Research Design

A research design ensures that there is a logical process to hold the research together by generating empirical evidence applicable to support the findings and subsequent recommendations of the study. McMillan and Schumacher (2010:20) described a research design as the procedures for conducting a study. Quantitative research, qualitative and mixed-method approaches are the three main categories of research designs (McMillan & Schumacher, 2010:11). The study used both quantitative and qualitative research approaches. This is referred to as a mixed-methods design (McMillan & Schumacher, 2010:39-41). Quantitative approaches adopt a positivist philosophy: they are objective, scientific, experimental and traditional. By contrast, qualitative approaches are phenomenological, i.e. they are subjective, humanistic and interpretative (Creswell, 2014:55), and, by involving aspects such as attitudes, values and perceptions to research studies, "add qualitative flesh to quantitative bones".

The use of both approaches, therefore, addresses the disadvantages of using one approach only. According to Schulze (2004:96), a mixed-methods design has the potential of producing holistic, comprehensive and insightful knowledge. Combining both approaches strengthens the study at hand and the internal validity of the design which form an important and integral part of research (McMillan & Schumacher, 2010:395). According to De Vos & Fouché (1998:360), there are three models of combining quantitative and qualitative approaches, one of which is the two-phase model. This study embraced the two-phase model which commenced with the quantitative phase followed by the qualitative phase. McMillan and Schumacher (2010:401) identified this model as a 'sequential explanatory design' and illustrated it as follows (Figure 1.1):

Figure 1.1: Sequential explanatory design

1.9.3. Quantitative and Qualitative Data

The qualitative data is used to explain the quantitative results and to elaborate on the quantitative findings with qualitative data explaining qualitative results and findings. Each phase is explained below.

1.9.3.1. The quantitative phase

This study used a quantitative research approach in the first part of the data collection. The study population comprised of primary-school teachers from public primary schools in four selected counties of Kajiado, Kilifi, Nairobi and Uasin Gishu in Kenya. The sample size was 352 respondent-teachers representing schools in 60 sub-counties.

1.9.3.2. The qualitative phase

This phase served as a follow-up to the quantitative phase. It involved selected head-teachers in charge of primary schools discussing the findings of the first phase and determining what they perceived as the problems with ICT support structures that could be addressed. The qualitative approach was thus aimed at obtaining, first-hand, head-teachers' sentiments on current factors impacting support structures for their teachers regarding ICT integration. Hence a phenomenological approach followed.

1.10.   STUDY POPULATION

Approximately 8 million people inhabit the four counties included in the study, namely, Kajiado Kilifi, Nairobi and Uasin Gishu, which represent seventeen percent of the total population of Kenya (Kenya Bureau of Statistics, 2019). The study population was all the primary-school teachers from 604 public primary schools in the four selected counties. The four counties were selected for the study since they represented rural (Kilifi and Uasin Gishu), peri-urban (Kajiado) and urban (Nairobi) areas. It was important to establish the teacher support structures and barriers to integration of ICT in the various environment to determine common and contextual strategies to motivate teachers towards improved learning outcomes in primary schools.

The populations of interest in this study were primary-school teachers and head-teachers in primary schools in Kajiado, Kilifi, Nairobi and Uasin Gishu counties, Kenya. There were 604 primary schools in the selected counties with an average ratio of six teachers per school. The inclusion criteria for the study were that the participants needed to be teachers and head-teachers with a practising certificate from the Teacher Service Commission in Kenya and had worked for more than one year. A total population of 3 400 male and female teachers who had been in service before this survey was conducted were included in the study.

Stratified random sampling was employed to categorise the four counties into four strata. Stratified random sampling is a probability sampling technique in which the defined target population is divided into groups or strata. Samples were then collected from all of these groups or strata (Cooper & Schindler, 2014:112). To sample the 3 400 teachers, stratified random sampling was applied to group all the public primary schools into representative groups as per the 60 sub-counties that existed in the four selected counties.

Kerlinger (1983) stated that 10–30 percent of any homogenous group is appropriate to constitute an appropriate scientific representation of the study population. Six (6) sub-counties that comprised 10% of the sample were randomly selected. In addition, from the six sub-counties, 10 percent of the teachers (n = 340) were selected. From each sub-county, two head-teachers were selected to constitute a sample of 120 respondents. The final sample size was 352 respondents. The procedure for sampling the teachers and head-teachers in the selected sub-counties was guided by Krejcie and Morgan's (1970) sample size estimation table.

1.11.   DATA COLLECTION TECHNIQUES

The instruments that were used in this study were questionnaires, interview guides and documentary reviews.

1.11.1. A Self-Administered Questionnaire

For this study, a self-administered questionnaire was the principal instrument used in data collection as it was deemed appropriate to collect data from a relatively large number of respondents in their natural setting and in a cost-effective way (Sekaran, 2016). The

questionnaire was administered to primary-school teachers in two methods: (i) hard copies issued to and collected from the school, and (ii) a link of an online survey platform where the questionnaire was uploaded was sent to the teachers on a mobile phone's instant messaging platform with instant feedback with their responses. The formulated questionnaire comprised of both closed and open-ended questions and consisted of two sections: Section A had short questions on the demographic and personal data of the teacher which helped to profile the teacher. The section also consisted of the independent variables of the study; and Section B consisted of the needs inventory which formed the dependent variables of the study. The inventory contained items on existing teacher support structures and those aspects that were deemed to be missing. The respondents were also required to indicate by using a tick against each item, how much they needed the services for their success as teachers. These items were assigned scale values as follows: 1 = Strongly Disagree; 2 = Disagree; 3 = Neutral; 4 = Agree; and 5 = Strongly Agree.

1.11.2. Key Informant Interview Guide

For a deeper understanding of the phenomenon of teacher support structures for effective implementation and management of ICT, in-depth interviews were conducted to collect data qualitatively through individual interviewing of information-rich participants identified in specific schools. The key informants for the in-depth interviews included twelve (12) head-teachers from the selected primary schools. This was purposely conducted to collect more extensive information about the study variables from the perspective of the education officials.

1.11.3. Documentary Review

These refer to records of past events in the form of letters, diaries and documents usually preserved in collections (Macmillan & Schumacher, 2010:361). These documents included teachers' files, school reports on the issuance of ICT materials and other related school records. They furnished the study with information regarding existing capacity for in-school ICT-in-Education support to teachers. In this study, the documents helped to determine the relationship among the study variables. Permission for data collection was obtained from relevant authorities to access the documents mentioned above.

1.12.   DATA ANALYSIS AND INTERPRETATION

For proper understanding and evaluation of the research questions raised and to ultimately achieve the research answers to the stated questions, different techniques of analysis pertaining to the different research approaches of quantitative and qualitative engagement were employed. The techniques of analysis used in the quantitative research approach consisted of a univariate and bivariate level of analysis applying to the objectives of the study. Qualitative data was analysed thematically.

1.12.1. Analysis of Quantitative Data

Both descriptive and inferential statistics were used to answer the research questions and to test the null hypotheses (McMillan & Wergin, 2010:12). The descriptive and inferential statistical analysis of the variables was used to meet the objectives related to determining existing support structures for teachers in Kenyan primary schools; and the effectiveness of existing support structures. These descriptive statistics were used to describe the variables while showing the mean and standard deviation of use of the various structures and the level of effectiveness. For Research Questions 3 and 4, (expressed gaps in teacher support needs for ICT; and sustenance of teacher interest and skills in ICT), descriptive and inferential statistics were also employed. The hypotheses were tested using ANOVAs (Analysis of Variance) (Creswell, 2014:64).

1.12.2. Analysis of Qualitative Data

For this study, content, narratives and discourses obtained from the Head Teachers and which formed the qualitative data, were transcribed, categorised into themes, and analysed thematically.

1.13.   RESEARCH ASSUMPTIONS IN THE STUDY

The sampling of primary-school teachers as key participants in this study was informed by a number of assumptions as follows:
1. Primary schools in the selected four counties have access to ICT infrastructure.
2. A policy on the integration of ICT in basic education exists, the teachers are aware of it and have been trained on it.

3. Primary-school teachers have access to ICT equipment for teaching and learning.
4. Teachers are computer-literate.
5. Teachers have the capacity to integrate ICT in their teaching methodologies.
6. Teachers have access, are familiar with and are currently using various ICT tools.

1.14.   LIMITATIONS AND DELIMITATIONS OF THE STUDY

Limitations and delimitations spell out the boundaries, exceptions, and reservations inherent in a study. While limitations aim at identifying potential weaknesses of the study, delimitations aim at narrowing the scope of a study thereby focusing on specific variables, specific participants, specific sites, or narrowing to one type of research design.

1.14.1. Limitations

Since few or no research is devoid of limitations, I was acutely aware of some limitations to this study which included: (a) participants' responses were self-reported which assumed that they exercised an acceptable degree of honesty; (b) years of service, levels of experience, and levels of education led to different responses from teachers; (c) temporal validity became an issue as this may take at least one academic year; and (d) ecological validity may be questioned due to the independent nature of the varied schools where the teachers are located.

1.14.2. Delimitations

Due to the above limitations, it was important that the study employed the following basic assumptions:(a) that the instruments used led to accurate and honest responses; (b) that the selected respondent-teachers from those schools had extensive experience in the use of ICT-in-Education; and (c) that the effectiveness of existing teacher support framework was measurable.

1.14.3. Ethical Considerations

At the onset of the process of data collection, ethical clearance was secured from UNISA (Appendix 1); permission to conduct research from the National Commission for Sciences, Technology and Innovation (Appendix 2) (which was duly granted (Appendix 3)); and

permission for the empirical investigation from country education officials introducing me to the school teachers was granted (Appendix 4). In addition, each questionnaire contained an opening introductory letter requesting respondents' cooperation by providing the required information for the study (Appendix 5). Interviews were conducted in the participants' own offices to minimise power differences that could prevail between me and the participants, as well as to engage participants optimally within their own comfortable working spaces. The participants were further assured of the confidentiality of the information provided and that the study findings were purely used for academic purposes. Participants were further assured of their personal protection and that they had the right to refuse or agree to be interviewed. The research, therefore, took cognisance of the need to employ ethical principles as follows:

- **Obligations to Society**: If this research was to be of benefit to society and the groups of individuals within it, it was imperative that the study is conducted responsibly and in light of the moral and legal order of the society in which i practised. To this effect, I had a responsibility to maintain high scientific standards in methods employed in the collection and analysis of data and the impartial assessment and dissemination of findings.

- **Obligations to Funders and Employer**: There was a need to ensure that my relationship with and commitments to funders and/or employers was clear and balanced. No compromise was made regarding the commitment to morality, to the law and the maintenance of standards commensurate with professional integrity.

- **Obligations to Colleagues**: This research depended upon the maintenance of standards and of appropriate professional behaviour that was shared by the professional research community. Without compromising obligations to funders/employers, subjects or society at large, this required methods, procedures and findings to be open to collegial review. It also required concern for the safety and security of colleagues when conducting field research.

- **Obligations to Subjects**: All necessary efforts were made to protect subjects from undue harm arising as a consequence of their participation in the research. This required that subjects' participation was voluntary, that they were as fully informed as possible and that no group was disadvantaged by arbitrarily being excluded from consideration. This relates to the requirements set out by Unisa.

1.15.   VALIDITY/RELIABILITY

Peer review and triangulation involve the practice of using multiple methods to establish the integrity and trustworthiness of the study and were used to ensure the credibility, transferability, dependability, and conformability of this study on teacher support structures for effective implementation of ICT in schools. Apart from peer reviewing and triangulation, other traditional practices, such as member checking and thick descriptions of the case were used to ensure the trustworthiness of the findings.

1.15.1. Validity of Instruments

Validity is the extent to which the measures used in the questionnaire are truthfully measuring the intended concept (Sekaran & Bougie, 2016:75-77) while content validity is the degree to which the instrument covers the content that it is supposed to measure (Cooper & Schindler, 2008:320-321). To validate the questionnaire, the study used face validity which is a form of content validity. This involved education experts reviewing and commenting on the content and quality of the questionnaire and interview guide. In line with Creswell (2014:40-41), the instruments were then adjusted from the results obtained from the peer review validation exercise to minimise errors and ambiguity.

1.15.2. Reliability of the Instruments

Reliability is the consistency with which a concept is measured (Creswell, 2014:49. In this study I checked validity of the questionnaires by pilot-testing and computing Cronbach's alpha (α). The feedback from the pilot study was used to refine the instruments to make them reliable for use during the study. Cooper and Schindler (2014:22-23) suggest that where Cronbach's α is used for reliability testing the rule of thumb to apply is that the Cronbach's α values of the

items to be included in the study should not be lower than 0.7. To increase the reliability of the instruments, this study used Cronbach's α for separate domains of the instruments.

1.16.   DEFINITION OF KEY CONCEPTS

ICT-in-Education includes the use of tutorial applications, simulations, modelling, data logging, graphing, multimedia, and the internet in the teaching and learning processes.

Information and Communication Technologies is defined by UNESCO as a diverse set of tools and resources used to communicate, create, disseminate, store and manage information (UNESCO, 2012:11). These technologies include computers, the internet, broadcasting technologies and telephony. In education, these tools are significant in helping teachers to employ innovative strategies to enhance the teaching and learning processes in schooling.

Learning can be seen as a lifelong process of skill acquisition and increased fluency. Learning involves a change in a person as regards their insight, behaviour, perception or motivation.

Primary-school teacher in the Kenyan public context is a professional who has qualifications or credentials from a teacher's training college to educate others. The teacher in an ICT-based environment should be computer-literate, information-literate and know how to integrate teaching methods with technology.

Teacher Support Structures refers to systems supporting professionalism and skills of a teacher to better understand, deliver and manage the ICT-assisted learning process.

Teaching refers to the actions of a live instructor designed to impart knowledge to the learner. Teaching is a human undertaking to help people learn.

1.17.   THESIS OUTLINE

This dissertation is organised into7 chapters:

Chapter 1 comprises the introduction of the study and highlights the importance of undertaking the study. The background information of the study is described highlighting the importance of integrating ICTs in various education systems to enhance the level of the teaching and learning process for the benefit of the knowledge society. The problem statement and sub-research questions are also highlighted. The formulation of the aim and objectives of the study and a discussion of the research methodology used to answer the research questions is included as well as the research aim. The chapter ends with a description of key terms relating to the study.

Chapter 2 introduces the literature review on ICT use in general and specifically in teaching and learning. The chapter starts by addressing the importance of ICT in the teaching and learning environment. The importance of teachers' use of ICT in school teaching activities is then highlighted as well as the crucial role of teacher support structures. The effectiveness of teachers' support for ICT in teaching and learning is addressed. The gaps existing in teacher support needs for ICT in the classroom environment in Kenya are discussed. Finally, the various endeavours for effective sustainability of teachers' interest and skills in ICT are highlighted. The chapter also examines the theories and the theoretical framework underpinning the integration of ICTs in basic education. Underpinning theories in the study are the Network Society Theory and Diffusion Innovation Theory which are examined in terms of ICT use in the learning processes and teacher support structures. A comparison of the theories is undertaken, with comparison and critique to ascertain whether they are relevant to the integration of ICT in basic education.

Chapter 3 explicates the research methodology appropriate in the study. It focuses on population and sampling, the research site, and instruments for data collection, namely, questionnaires, interview guides and documentary reviews. It then goes on to deal with the analysis of data, validity and trustworthiness of the study and the analysis of the research data. Finally, the chapter considers the ethical issues related to the study.

Chapter 4 presents the results of quantitative data analysis based on selected statistical techniques used. Interpretation and presentations of the findings of the quantitative data analysed is also undertaken.

Chapter 5 presents findings of the qualitative data analysis emanating from generated themes and sub-themes. Profiling of the participants and results of document analysis are included.

Chapter 6 presents the data analysis and interpretation by triangulating quantitative, qualitative and document review findings and comparing them with the literature and their contribution to the body of knowledge.

Chapter 7 gives a summary of the study findings as well as the recommendations arising from the study. A discussion of the conclusions relating to the research questions as well as the study limitations were expressed. Finally, recommendations related to teacher support structures in ICT are made as well as suggestions for further research.

1.18.   SUMMARY OF THE CHAPTER

This first chapter of the study constitute an overall introduction to the whole research, form its background, to context, to research activities and to its findings. The chapter brings forth the importance of teachers support for effective use of ICTs and goes ahead to interrogate existing such support structures in Kenya primary schools. The chapter also delves briefly into the limitations and delimitations of the study. The source and importance of the problem and the way forward to find answers to the research questions are elucidated. This was followed by the expected contributions of the study, and research philosophy and paradigms. The description of research methodology that includes sources of data, instruments of data collection, methods/tools of data analysis, and population, sample size, and sampling techniques of the study are also briefly presented. The chapter also explains how the study ensured transferability and reliability of data in the study. As its conclusion, the chapter presents a chapters-outline as a sequencing of the entire study and a summary of Chapter 1.

CHAPTER TWO

A LITERATURE REVIEW OF TEACHER SUPPORT STRUCTURE FOR ICT
IMPLEMENTATION IN PRIMARY SCHOOLS

2.1. INTRODUCTION

Chapter 1 highlighted the background of the study illuminating the statement of the problem through the introduction of research questions. Chapter 2 reviews the literature anchoring the research questions. The purpose of this literature review is to scrutinise other studies that are related to teacher support structures for effective implementation of ICT. The review starts with general information on the study's country and moves on to unpack the concept of ICT-in-Education globally followed by one for Africa and narrowing down to Kenya.

The importance of teachers' use of ICT in school is then highlighted as well as the crucial role of teacher support structures. The effectiveness of these support structures is addressed and finally, the gaps in teacher support needs for ICT in the classroom environment in Kenya are discussed.

2.2. AN OVERVIEW OF EDUCATION SYSTEM IN KENYA

This section provides an overview of the study's country, its education system and some of its ongoing initiatives towards ICT in Education.

2.2.1.   Kenya: the country

Kenya, officially the Republic of Kenya, is a country in Eastern Africa. It has a population of more than 47.6 million as at the 2019 national census, 75% of whom are under 30years in a rapidly growing population. It occupies about 580,367 square kilometres with an Indian Ocean coastline stretching 1,420 kilometres. Kenya's climate varies from tropical along the coast to temperate inland to arid in the north and northeast parts of the country. The country was a colony of the British until 1963 when it gained its independence. Its economic activities include

tourism, agriculture, manufacturing, technology, and recent oil exploration. While there are more than 40 indigenous languages spoken in the country, Kiswahili and English are the official languages of communication.

2.2.1.1.   A map of Africa locating Kenya

The map of Africa below (Figure 1.2) locates Kenya in the Continent while the subsequent map of Kenya (Figure 1.3) depicts the various Counties in the country and pin-points the four counties which formed the research sites of this study.
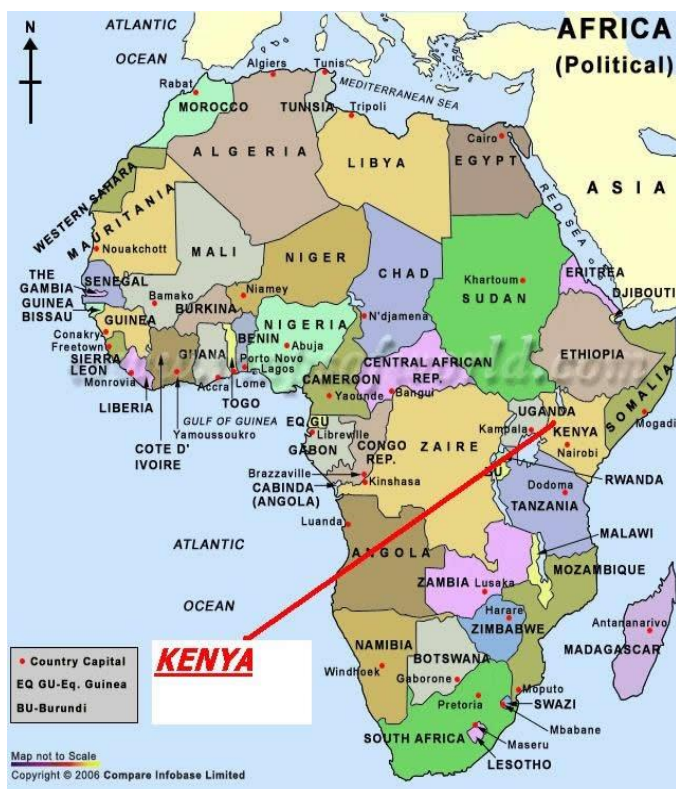
Figure 2. 1 Map of Africa

2.2.1.2. Map of Kenya and its Counties

The Research Sites of four counties: Kilifi, Uasin Gishu, Kajiado and Nairobi

Figure 2.2 Map of Kenya

2.2.2. Kenya Education System

In view of the fact that the purpose of this study was to interrogate the existing teacher support structures in Kenya's public primary schools to ensure optimal use of ICTs, this section delves into the general details of the Kenya-specific education system.

2.2.2.1. General Education Information

Since independence from colonialism in 1963, Kenya has prioritised education as a national goal. Kenya is acutely devoted to the implementation of international and regional education commitments such as the Education for All (EFA) goals and Sustainable Development Goals (SDGs), among others (Government of Kenya, 2018). The Ministry of Education (MoE), formerly Ministry of Education Science and Technology (MoEST) is responsible for national policies and programmes that ensure that Kenyans access quality and affordable education. State Agencies working under the MoE, support the various functions including: Kenya

Institute of Curriculum Development (KICD) who's primary function is to provide curricula and curriculum support materials; Kenya National Examination Council (KNEC) is responsible for learner assessment; and the Teacher Service Commission (TSC) which is an independent commission tasked with all aspects of managing the teaching service for quality education and development.

The Kenyan education system is centralised with little flexibility for individual schools and regions to adapt the curriculum and the material to their specific needs (UNESCO, 2014:56-57). While the official primary school starting age is 6 years, it varies considerably with learners starting between the ages of 4 and 10 depending on various factors. Entry into public secondary and university education is through selection based on performance in the national examinations. These exams are highly competitive and determine learners' futures schooling trajectory (OECD, 2015:23).

With high unemployment rates and an ambition to compete in the global arena, education for many of the Kenyan youths is the key to a brighter future (Engelska, 2016:9). Kenya's two official languages are English and Kiswahili which are also largely used as the languages of instruction alongside other indigenous languages. At national assessments level, the language of education has been English. All primary education is compulsory with the school year running with the calendar year from January to December. There are holidays of 3 to 4 weeks in April and August for both primary and secondary education. The longest holiday takes place during November and December months. The academic year for universities runs from September to June (Ouma, Awuor & Kyambo, 2013).

The goal of education in Kenya is to provide globally competitive quality education, training and research for development.

2.2.2.2. Historical Overview of Kenya Education System

With the formation of the East African Community (EAC) in 1967, Kenya adopted the single system of education, 7-4-2-3, shared across the region. Upon the collapse of the EAC in 1977, Kenya continued with the same education system but re-structured the examinations from regional to in-country assessment and certification. The East African Certificate of Primary Education became the Certificate of Primary Education (CPE), the East African Certificate of

Education became the Kenya Certificate of Education (KCE) and the East African Advanced Certificate of Education became the Kenya Advanced Certificate of Education (KACE).

In 1985, the 8–4–4 system of education replaced the 7-4-2-3 where learners would spend 8 years in primary education, 4 years in secondary School and 4 years at the university. With the introduction of the 8–4–4 system CPE became Kenya Certificate of Primary Education (KCPE) while KCE and KACE became the Kenya Certificate of Secondary Education (KCSE).

Kenya was yet again to introduce a new system of education in 2017 to replace the 8-4-4 one with the Competency Based Curriculum (CBC). The CBC was designed by the Kenya Institute of Curriculum Development (KICD) with the aim of churning out 'engaged, empowered and ethical citizens. The new curriculum runs on a 2-6-3-3 System of Education where basic education has been organised in three levels; Early Years Education, Middle school Education, and Senior School. Learners have 2 years in Pre-primary, 6 years in primary (Grade 1-6), 3 years in junior secondary (Grade 7,8,9), 3 years in senior secondary (grade 10,11,12) and 3 years in university.

2.2.2.3. The CBC

The new 2-6-3-3-3 system of education is aimed at providing relief from the content-overloaded, teacher-centred 8-4-4 system of education. The system emphasises Continuous Assessment Tests as opposed to the high-stake national examinations. It's implementation has been phased-out in tiers with the first rolled out in January 2018 targeting pre-primary school and Grade 1, 2 and 3. It is envisaged that by 2027, the first cohort will complete CBC's Basic Education. The following matrix in fig 1.4 summarises the 2-6-3-3-3 system of education implementation plan over a period of six years (KICD, 2017:12).

Grade	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
PP1-G1&2	Phase 2 Pilot									
G3	Std.3									
G4	Std.4									
G5		Std.5								
G6			Std.6							
G7				Std.7						
G8					Std8					
G9						F.1				
G10							F.2			
G11								F.3		
G12									F.4	

Key:
Phase 2 Pilot
CBC rollout
8-4-4
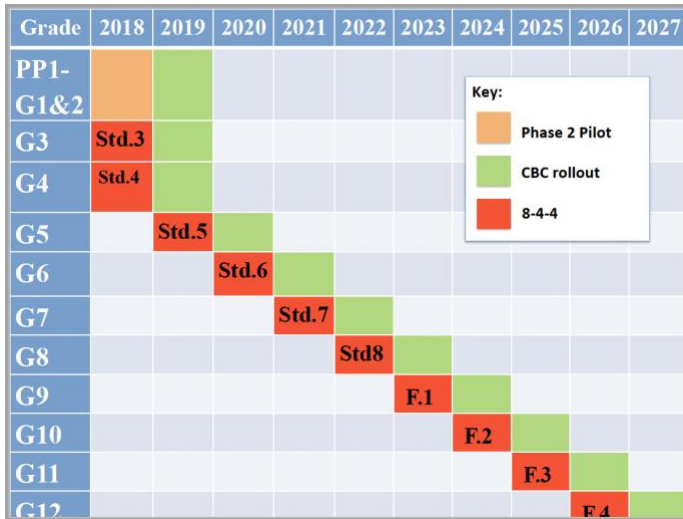
Fig. 1.4: New 2-6-3-3 system of education

The implementation of the new system of education has implications for current and future teacher training. The new system centres on competence and skill-building as opposed to the 8-4-4 that was an exam-centric system of education. The system marks a new beginning in teaching and learning, with more activity-oriented learning, and emphasis on extra-curricular activities (KICD, 2017:13).

2.2.2.4. Early Childhood Education

In the realisation that an effective Early Childhood Development and Education (ECDE) programme enhances a country's socioeconomic and political stability, the Government of Kenya recommended the development of a comprehensive ECDE policy framework and service standard guidelines, culminating in the National Early Childhood Development Policy Framework (Government of Kenya, 2006) which is entrenched in it Kenya Vision 2030 (Government of Kenya, 2008).

2.2.2.5. Primary School Education

There are about 24,000 primary schools in Kenya and about 1o million pupils within the 8-4-4 system of education which is in transition. The current Constitution of Kenya (Government of Kenya, 2010) has also provided for free and compulsory basic education at the primary level. Primary education has been free and compulsory since 2003. Pupils are usually 6 years old

when they start school and 14 when they complete their primary education. The curriculum is made up of languages, mathematics, history, geography, science, crafts and religious studies.

2.2.2.6.   Secondary School Education

Secondary education is also free, but not compulsory. Most pupils are 14 years old when they start secondary education. Kenya has more than 10,000 public and private secondary schools, with about 3.5 million students. Less than 50 percent of primary-school pupils transition to secondary education. Secondary education graduates transitions to either the labour market or to various levels of tertiary education. In the current system, secondary education ordinarily takes 4 years (Ouma et al., 2012). The curriculum is made up of subjects divided into five groups: Group 1: English, mathematics and Kiswahili; Group 2: biology, physics, chemistry, physical education and biological sciences; Group 3: history and government, geography, Christianity, Islam, social studies and ethics; Group 4: home science, art and design, agriculture, woodwork, metalwork, construction, power mechanics, electricity, drawing and design, and aviation technology; and Group 5: French, German, Arabic, music, commerce, economics, typing and office practice. The subjects in Group 1 are compulsory for all pupils. They must also choose at least two subjects from Group 2, and can choose freely from the other groups. At the end of the fourth year, students seat a final national examination.

2.2.2.7.   Post-Secondary Education

Post-secondary education is either in Universities or Technical and Vocational Education and Training (TVET). Through the 2012 TVET Policy, the government aims at providing, promoting and co-ordinating TVET and assuring quality, inclusiveness and relevance (Wanzala, 2017:35). TVETs offer technical study programmes delivered by various technical training institutes and institutes of technology. The admission requirement is generally a KCSE with a C-average. The study programmes offered by technical training institutes and institutes of technology vary in duration. Post-secondary study programmes also lead to a variety of certificates and diplomas. The level of each study programme must be assessed individually and depends on its duration and specialisation. Admission to Kenya's public universities is managed by the Kenya Universities and Colleges Central Placement Service (KUCCPS). KUCCPS is an umbrella body for admissions, with representatives from all public universities as well as the MOE and the Commission for University Education (Ouma et al., 2015).

2.2.2.8.   Current State of Education in Kenya

Kenya's education sector is experiencing a period of increased investment and attention. With the pressing demand created by a growing population, the government is focusing on improving access and quality across the system. The attention on the sector and the desire to align the system with the needs of the labour market has seen a greater involvement of the private sector players. Kenya's key indicators are relatively sound. The Gross enrolment at the primary and secondary levels stood at 103.6 percent and 62.9 percent, respectively, in 2015. Indeed, the number of Kenyans attending primary and secondary schools increased by 400 000 pupils in 2015 alone, which, at the secondary level, represented an annual increase of 9.7 percent. The number of primary schools increased by 6.4 percent in 2015, while for secondary schools, that number stood at 7.9 percent (OECD, 2015:24).

Kenya has also increased the total number of teachers by 5.1 percent. In terms of learner performance, over 80 percent of Kenyan children reach the expected reading level after four years of schooling. This is well above the sub-Saharan African average of roughly 62 percent. As part of its strategy to improve access, the Government of Kenya has increasingly devoted funds to ensuring free primary education and free tuition across the public system. Indeed, the budget allocation for free schooling increased by 33.3 percent to KSh40bn ($390.3m) in the financial year 2015/16. This was part of a plan to ensure free and compulsory basic education moving forward.   As part of this process, the government allocated KSh3bn (USD29.3m) in funding to cover examination fees associated with both the KCPE as well as the KCSE (KICD, 2017:13).

While primary school is free across the public system, at the secondary level there are still costs for parents. However, the national government has taken steps towards improving access and attendance by setting a cap on secondary-school fees, with the total annual costs of KSh53,500 (USD522) for state boarding schools and KSh7900 (USD77) for state day schools. The overall cost of secondary education is partly subsidised by the government, with the current contribution of KSh12,870 (USD126) per learner per year and this has helped push up the attendance rates. In June 2016, President Uhuru Kenyatta promised to make secondary education completely free within the following three years and pledged to significantly

improve the quality and standards of education, and reduce the impediments faced by parents in accessing secondary education for their children.

2.2.2.9.   Teacher Professional Development

The Government of Kenya is acutely cognizant of the fact that teachers are one of the most important variables affecting learning outcomes in schools. The manner in which the country sources, develops, deploys, manages, and supports teachers largely determines or influence the quality of education. Currently, the government, through the Teachers Service Commission (TSC) manages a workforce of more than 300,000 teachers deployed to about 30,000 public basic education institutions in the country. These include more than 200,000 teachers serving in 24,000 public primary schools and about 100,000 teachers serving in more than 8,000 public secondary schools.

2.2.3. Integration of ICT in Teaching, Learning and Assessment in Primary Schools

Kenya has continually invested in ICT integration in education to enhance access, quality and equity. There are various initiatives in ICT integration in education by both the government and other stakeholders. Key among these is the DLP, which targets all public primary schools. In this programme, each school is provided with digital resources for effective curriculum delivery. One of the challenges of this initiative has been identified as a lack of ICT skills among teachers.

2.3. DEFINING AND UNDERSTANDING THE CONCEPT OF ICT

There is no universal definition of ICT but, for this study, I considered and adopted the explanation that ICT is the combination of four integral components, namely, the 4Cs of computing, communication, content and capacity. Capacity, in this case, is the human interaction with the other 3Cs that form the basis of this study within teacher capacity.

ICT has not only permeated all sectors of the world economy but has also heavily affected our personal life providing dynamic, better, and quicker ways to interact, network, seek help, gain access to information, and learn. ICT is pervasive throughout all industries and its effective use

yields tremendous benefits for manufacturing, commerce, healthcare, environmental action, and education, amongst others.

ICT-in-Education has the potential to provide new ways of learning for students and teachers; to ensure inclusion for special needs learners; to promote higher-order thinking skills; to enhance subject matter mastery; to develop ICT literacy and ICT capability in students; to encourage collaboration; motivate learning; improve engagement and knowledge retention; and allow for effective differentiation of instruction using technology.

2.4. RESEARCH ON THE IMPORTANCE OF ICT-IN-EDUCATION

ICT in developing countries has been praised by several scholars as a tool for reducing high unemployment rates and poverty (Keengwe & Malapile, 2014:704). However, technology will only have a positive effect on these different areas of society, including when it comes to education if people are willing and have the capacity to put it to positive use (Toyama, 2011:77). This further means that for it to have a positive effect on education, teachers need , first of all, to have a positive attitude towards ICT and, secondly, to be trained to incorporate it into their teaching, which requires more than simply having technical skills (Nyagowa, 2014:236).

The training should also include giving teachers the confidence to use digital tools together with their learners by, for example, showing them how the tool can be an important asset to their teaching (Gudmundsdottir, 2010:183). Research has shown that the implementation of different kinds of ICT tools can facilitate a pedagogical shift from the teaching having a mainly instructive approach to an approach with enhanced communication between the teacher and the learners, if used correctly (Wims & Lawler, 2017:7).

In a report published by UNESCO, Anderson stresses that ICT transforms the teacher until they are no longer the "all-knowing authority". This is because of the information the learners gain access to with the ICT tools, which transform the teacher into a facilitator for the learners leading them through their learning process (Anderson, 2010:6). One of the largest obstacles from the teachers' point of view though is that they lack relevant competence in the field of ICT. Research has shown that there is an extensive need to incorporate ICT skills into teacher education in developing countries (Trucano, 2012).

Since ICT is of major significance in this study, there is a need to clarify its role in the teaching and learning process. UNESCO (2012:2-3) stated that ICT refers to the methodologies where technology is applicable in the processing and use of information and communication electronically. It also integrates the process of acquiring, storing, processing, and disseminating information electronically. The tools used in this process range from the hardware, software applications and information systems essential for the transmission of information to wherever it is needed.

Shan Fu (2013:112) endorsed this definition by stating that electronic delivery systems are in use globally and specifically in the education sphere, purposely geared towards creating an enabling platforms for teaching and learning to occur anytime and anywhere. Shan Fu further stated that ICT is crucial in the acquisition and distribution of knowledge and can be equated with the significant impact of the invention and use of electricity during the industrial age.

2.4.1. Global Importance of ICT Skills

Globally, the education system has witnessed remarkable changes especially with the rapid growth of ICT in the 21st century. The importance of education has been recognised as the means of promotion of social and economic development both for individuals and the country. As a consequence of the growth of an information-oriented society, education systems in the world have been forced to embrace the use of technology in the process of inculcating values and skills needed by learners (UNESCO, 2012:34). Teaching methodologies in schools have undergone a phenomenal revolution as a result of the integration of ICT specifically with the emergence of learner-centred forms of teaching and learning. Integration of ICTs brings revolutionary changes in teaching methodologies (Smaldino, 2012:23-25). The learner-centred teaching and learning approach has required teachers to integrate ICT in their teaching methodologies to cascade the same to the learners with the sole aim of empowerment of learners in the digital age.

Due to the proven importance of technology in both developed and developing countries, the use of ICT is rapidly being used as a means of significant growth in the social and economic arena and enabling the society to fully participate in the knowledge society. In countries like the Republic of South Korea, the use of ICT is not only for the advancement of the society's

ideals in the knowledge society but also a tool of advancement in teaching and learning activities in schools. In South Korea, the use of ICT is a tool for bridging the digital divide as well as promotion of equity in the education sphere and as a parameter for enhancing the quality level of education through enhancement of teaching methodologies of teachers especially for the promotion of science and technology (Hwang, 2013:7).

2.4.2. Importance of ICT Skills in Developing Countries

Developing countries are cognisant of the importance of ICT-in-Education since it is viewed as a solution for the social ills that bedevil society such as poverty and ignorance. ICT-supported education is thus a tool for bridging the digital divide where the youths are equipped with the much-needed values and skills to enhance the eradication of poverty and lead to the advancement of the economies of these countries (Molotsi, 2014:77). In the education sector of the developing countries, the acquisition of ICT in the education sector is clearly identified as a means of jump-starting the process of globalisation and technological advancement (UNESCO, 2013, 22). It is further understood that ICT tools are resources that can be used by teachers and learners to enhance and advance rapidly the quality of education since ICT-related tools like computers and internet connectivity can assist in browsing the internet, storage, management and dissemination of information.

The importance of ICT from the viewpoint of education is that it is a valuable foundation of education in the knowledge society since it enables learners to acquire, share and distribute knowledge. It enables the learner to make use of available and accessible knowledge multiple times without depreciating and, in the process, provides a platform for sharing knowledge by many people at little cost (Molotsi, 2014:34). ICT is an essential tool for teacher support in the teaching and learning process since it enables access to teaching resources for the teacher which makes learning accessible and offers support in research activities (Makura, 2014:43). Teachers are, therefore, important tools in enabling and promoting the accrued benefits of the use of ICT-in-Education and are responsible for the production of knowledgeable learners who will play a vital role in the process of growth and advancement of the developing countries.

2.4.3. Importance of ICT Skills in Africa

In Africa, various countries have recognised the importance of ICT in the advancement of the education sector as a platform for economic growth. The integration of ICT into teaching and learning is high on the education agenda in South Africa, particularly with the release of the White Paper on e-Education in 2004. The paper highlights the complexity of ICT access and reflects on both the stages and types of ICT integration. Factors affecting ICT integration in South African classrooms are discussed, as are learner and educator responses to technology-integrated lessons. The data presented suggests that use and some degree of integration of technology at the classroom level appear to be taking place, with 48.5% of respondents indicating that they implemented a technology-integrated lesson more than once a month, 13.5% about once per month and 9.2% less than once per month.

2.4.4. The importance of ICT skills in South Africa

In the South African education system, technology is a subject offered in primary schools as Natural Sciences including Technology and in high schools as Computer Application Technology. The teaching of Natural Science including Technology at the primary level is aimed at enabling the learners to develop a mindset of enjoyment and curiosity about the world and natural phenomena. The learners are also expected to gain an understanding of different cultural contexts in which indigenous knowledge systems are developed (Mukhari, 2016:8). Mukhari (2016:9) added that the rationale for teaching technology subjects is to enable elementary engineering and technological skills acquisition by the learners which are crucial for the world of work, higher or further education and self-employment.

Motene (2016:15) further clarified that technology subjects in the South African education curriculum are offered for social, vocational and economic reasons which are held in high esteem in the knowledge society. Other subjects where ICTs are integrated into the curriculum are Language Literacy and Mathematics. The emphasis on the integration of ICT in these subjects is because these are the subjects where learners in South Africa perform poorly as per the Progress in the International Reading Literacy Study (PIRLS) and Trends in International Mathematics and Science Study (TIMSS) assessments (HSRC, 2011:4).

2.4.5. The importance of ICT skills in Rwanda

In Rwanda, there is evidence of the integration of ICT-in-Education as established by Mukama (2009:12) description of a study conducted in Rwanda involving 12 participants selected from a larger cohort of 24 final-year university students who were part of a group-based training programme. The programme was about how to search, retrieve and use web-based literature. The purpose was to explore ways of using ICT in student teachers' everyday teaching practice. The study drew on a socio-cultural perspective and emphasis was put on a literature review involving ICT in teacher education. The findings revealed that use of ICT pertains to three major types of variation among student teachers who use ICT: passive, reluctant and active users. The active ICT users demonstrated a capacity to cross group boundaries and play a central role as agents of change in learning practice. It emerged that more experienced student teachers could assist their colleagues in the zone of proximal development and, therefore, enhance the integration of the new technology in teacher education.

2.4.6. The importance of ICT skills in Kenya

According to Tonui, Kerich and Koross (2016:13), remarkable progress has been made in Kenya in promulgating an ICT policy framework and implementation strategy, complete with measurable outcomes and time frames. The first effort was the creation of a national ICT policy in January 2006, aimed at advancing the livelihood of the Kenyan people through availing and accessing efficient, cost-effective and reliable ICT services. This was driven by the objective of the government of transformation of the Kenyan economy through the development of the ICT sector in collaboration with the private stakeholders (Michael, 2016:22). The government viewed an ICT-driven economic sector as a critical tool for employment creation, poverty eradication and a broad-based enabler for economic recovery as well as the advancement of the achievement of economic goals. Since this study is based in Kenya, the ICT initiatives undertaken in the country are discussed in detail in the following sections.

2.5. ICT INFRASTRUCTURE IN PRIMARY SCHOOLS IN KENYA

In Kenya, ICT-in-Education is a relatively new area of research. However, there are useful publications that date back to an evaluation of one of the earliest attempts at the computer deployment project in the country. The Computers-in-Education Project in Kenya (CEPK) was

established in April 1983. With funding from the Aga Khan Foundation, a pilot phase was conducted with computers introduced in one secondary school in Nairobi.

For the next two years, CEPK was subjected to both in-house and external evaluations leading to additional funding from Apple Inc., the International Development Research Centre (IDRC) and the Rockefeller Foundation. A three-year Phase II began in 1986 with five more secondary schools distributed throughout Kenya being brought into the project and each received computers, software and teacher training. During the three years of Phase II, this innovative project was studied and formed the foundation of future endeavour of integration of ICT in the education sector in Kenya (Michael, 2016:21). Further attempts at implementing ICT in schools were initiated by publishing Sessional Paper No. 1 of 2005 with ICT deployment in schools being a priority. The session paper aimed at equipping secondary schools in Kenya with ICT support infrastructure with priority given at integrating existing school curriculum to meet the challenges of the information society. In every school, teachers, learners and the neighbouring community were to benefit through participation in the acquisition of ICT skills necessary for benefiting from a knowledge-based economy by the year 2015. Learning and teaching in schools were to be transformed to embrace ICT skills appropriate for the 21st century (Omariba et al., 2016:23).

As far as the integration of ICT in primary education in Kenya is concerned, the National Education Sector Plan: 2013-2018 prioritised the integration of ICT into teaching and learning as a key parameter. This has witnessed several initiatives established by the government in collaboration with the private sector. These initiatives included the NEPAD E-Schools Project, Accelerating 21st Century Education (ACE) project aimed at improving the quality of primary and secondary education through the effective use of ICT (a project by a partnership between the Clinton Global Initiative, Cisco, Intel, Microsoft and USAID); iMlango Project aimed at using ICTs to improve the learning outcomes of marginalised people in a partnership between UKAid and four private firms; and the Digital Learning Programme by the Government of Kenya targeting all the primary schools in Kenya.

Though the Government of Kenya has made huge strides in integrating ICT in the primary education sector to catapult the country towards becoming a middle-level economy as envisaged in Kenya Vision 2030, challenges abound. These challenges include a lack of methodologies for transforming the curriculum and a lack of effective support strategies for

teachers to advance the ICT projects among many others (Nyagowa, Ocholla & Mutula, 2014:6). Having examined the critical role of ICTs in the education sector, the next section aims at assessing the importance of the teachers' use of ICT in the teaching and learning process.

At a national level, Kenya's Vision 2030, a long-term development blueprint for the country, states that the country will be "a globally competitive and prosperous country with a high quality of life by 2030". It aims to transform Kenya into "a newly-industrialising, middle income country providing a high quality of life to all its citizens in a clean and secure environment". To realise this, there are implications for education such as learning ICT skills and learning by ICT. Therefore, the MOE intended to make ICT a compulsory subject at all levels (Bunyi, 2013:686). Further, Kenya developed its first National ICT master plan in 2014 which highlighted the need for ICT as part of the teacher training college programmes (ICT Authority, 2014:11).

2.5.1. Digital Literacy Programme in Kenya (ICT Integration in Primary Education)

The ICT Integration in Primary Education (DLP) is one of the key flagship programmes highlighted in the ruling party (Jubilee) Manifesto in Kenya. The main aim of the project is to align the integration of ICT into teaching and learning for Standard 1and 2 pupils in primary schools. The components of this project included the deployment of ICT infrastructure; development of digital content; and capacity building of the teachers. This initiative adopted a multi-ministerial consortium approach led by the Ministry of ICT and MOE and included Ministries of Energy and Internal Security amongst other state agencies.

The capacity building for eachers was done by national trainers who were drawn from the MOE's semi-autonomous agencies mandated with training, namely, Kenya Education Management Institute (KEMI), Kenya Institute of Special Education (KISE) and Kenya Institute of Curriculum Development (KICD). Others were high school teachers who are Computer Studies teachers and had undergone prior training in ICT integration in teaching and learning. In addition, 2 555 teachers were trained as Trainer of Trainers (ToTs) drawn from all 47 counties in Kenya. This group underwent training at the counties offered by the Master

Trainers. The ToTs were expected to carry out training of teachers in their respective sub-counties.

The Field Officers (County Directors of Education and Sub-County Directors of Education) coordinated the training of 62 784 teachers nationally drawn from all public primary schools. The digital content for Standard 1 and 2 digital content was also developed and piloted in 40 primary schools and to ensure that it met the curriculum objectives. Software for special needs learners is being developed by KICD. The MOE also carried out a needs assessment to ensure the schools had the appropriate infrastructure for the rollout of the ICT integration in primary schools. Each public primary school received a minimum of KSh60 000 to cater for refurbishment of classrooms and storage rooms, purchase of storage cabinets and installing window and door grills.

The above status was as at the time of this research.

2.5.2. The interface between the CBC and DLP

The new Competency Based Curriculum responded to the exigencies of relevance in changing societal needs and aspirations of the nation as articulated in various national policy documents. Digital literacy is one of the competencies embedded in the CBC in order to prepare learners for the 21st century skills. The Government of Kenya deployed devices to lower primary schools as part of the wider Digital Literacy Programme (DLP) to support teaching and learning in CBC.

2.6. IMPORTANCE OF TEACHERS USE OF ICT IN TEACHING AND LEARNING

With the worldwide development of ICT, there is a necessity for educational institutions to accelerate the use of ICT to enhance the teaching of lifelong skills and knowledge to enable learners to possess skills for survival in the global job market. The educational institutions have realised the magnitude of the role of ICT in shaping the daily survival of individuals (Omariba et al., 2016:25). They have thus strived to restructure their education curriculum and their classroom facilities to bridge the knowledge gap in the teaching and learning process. The restructuring process necessitates the acquisition of effective skills to drive the integration of

technology into the existing education system. This is aimed at enabling learners to access a conducive environment for the acquisition of knowledge in specific subject areas to promote meaningful learning and to enhance the productivity of future citizens (UNESCO, 2012:33).

The entry point for the integration of ICT in teaching and learning is ensuring that teachers embrace these new possibilities and acquire skills of integration of ICT in their teaching methodologies to empower learners to creatively compete in the global world (UNESCO, 2012:34). Teachers' tasks in this process include evaluating ICT tools, assessing ICT competencies of learners, setting clear expectations, negotiating objectives with learners and preparing learners for lessons by adopting various scaffolding strategies (UNESCO, 2012:35). Teachers must be learners who keep on developing and enhancing their own ICT capacity to guide their students. Teaching with ICT tools in primary education requires teachers to behave like learners themselves in the computer-enhanced environment (Park, 2016). This is because teachers are working with learners with extensive contact with ICT as an integral part of their world. Though global governments have invested heavily in the integration of ICT in the education sector, little has been done on the preparation of the teachers and the teaching and learning infrastructures, especially in developing countries.

Though studies have been undertaken to investigate factors related to the use of computer technology in teaching and learning by teachers (Michael, 2016, Motene, 2016; Taban, Mamun & CheKum, 2013), the findings show that there is little emphasis on teacher preparedness to integrate these technologies in primary schools' teaching and learning, which this study sought to interrogate. Park (2016:4-6) concurred that though there is a heavy investment in ICT in the education sector, the impact of it's integration is yet to be fully felt in teaching and learning. This observation is applicable in the Kenyan context.

Countries like the United States, Australia, Japan, Malaysia and the Philippines have ongoing initiatives on ICT integration in education (Nut, 2010). Some have even created competency standards for technological use. However, integrating ICT-in-Education is a complex process of educational change and the extent of integration in many countries, Kenya included, is extremely varied and in most cases, very limited. The challenge with the integration of ICT in teaching and learning has been the lack of technical support for teachers (Gode, 2013). The availability of technical support for teachers in institutions means the use of ICT in teaching without losing time especially in having to solve software and hardware problems. Computer

breakdowns lead to learning interruptions and without computer technicians who can give technical assistance, it is likely that the regular repairs of the computer will not be carried out which discourages teachers from integrating ICTs into their teaching. Besides equipment breakdown, teachers' fear of equipment failure sometimes restricts their interaction with them. Thus, without technical support for teachers, they become frustrated resulting in their unwillingness to integrate ICT to teach (Gode, 2013; Muyaka, 2012).

In this technological era, teachers' use of ICT in teaching and learning is further inspired by the fact today's learners are heavily stimulated by ICT and use them in most of their daily activities. Therefore, a little or lack of ICT in schools will deprive learners off an opportunity to actively participate in learning activities and thereby may exclude them from the global community. As a key variable in the development of the future workforce, a teacher must familiarise with new technology to cope with developments and ensure educational and national ICT objectives are attained. Teachers must start by using available ICT resources to acquire minimum basic skills to be build-on as new technologies emerge. As they grow more confident, they will be in a position to progress to an advanced level of ICT use which will improve teaching and learning in their education activities at school.

In understanding the importance of teachers integrating ICT in teaching and learning, Taban et al. (2013:1) focused on finding out the difficulties faced by teachers in using ICT in teaching-learning in technical and higher educational institutions in Uganda. The study used a descriptive method with quantitative analysis. The sample of the study was selected from 150 teachers and 75 administrators from five technical and higher educational institutions of Uganda. The findings revealed that teachers had a strong desire to integrate ICT into the teaching-learning process even though they expressed inherent difficulties in this process.
The major barriers included: lack of authentic software, inadequate numbers of computers in the classroom, low-speed internet, lack of motivation from both teachers and students to use ICT, lack of proper training skills, unavailability of the latest ICT equipment, lack of expert technical staff, poor administrative support and poorly aligned curriculum to ICT. While a lot can be borrowed from Taban's study it should be noted that this study was done in public primary schools in Kenya and therefore yielded some varied findings.

On the same note, Michael (2016:34) investigated the factors influencing teachers' participation in the integration of ICT in teaching and learning in public secondary schools in

Machakos Sub-County. The study adopted a descriptive survey design with a sample of 21 secondary-school head-teachers and 126 teachers. The study used questionnaires to collect data. Findings established that majority of the head-teachers and teachers had basic ICT literacy while only a few head-teachers and teachers integrated ICT in teaching and learning due to their limited competency in ICT skills. Many secondary schools had computer laboratories but inadequate numbers of computers or computers that were not up-to-date. The study findings showed a significant relationship between teacher competency and ICT integration. The findings also established that teacher gender and ICT integration were independent variables. The importance of teachers integrating ICT in teaching methodologies is emphasised in this study. However, it needs to be stressed that little knowledge is disseminated on the necessity of support structures for teachers in the process of ICT integration. Furthermore, Michael's study was conducted in secondary schools in Kenya which may have a different policy framework for ICT integration with the current study which focused on teachers in primary schools.

Other scholars like Motene (2016:2) aimed at designing and developing ICT instructional tools which were to be used to train teachers in primary schools on how to integrate ICT into teaching and learning. Design research and instructional design theories were employed in guiding this study. The study used the Analysis, Design, Development, Implementation and Evaluation (ADDIE) model of instructional design as a guiding principle in the design and development of the tools. The participants were 28 teachers from three primary schools. The results of the study revealed that the capacitation of teachers lays the foundation for ICT integration into teaching and learning. Giving computers to schools can lead to successful integration once the teachers feel competent to use them. Furthermore, it is crucial that other intervention strategies to empower teachers be explored.

Michael (2016) and Taban et al. (2013) highlighted the importance of support structures for teachers. However, the actual strategies for supporting teachers in ICT integration are not clearly articulated. Though the study is focusing on primary schools, it was based in South Africa, a country with different ICT integration policies from Kenya. Nevertheless, given these findings, I am of the opinion that it is incumbent on teachers to acquire the skills necessary to be able to use ICTs effectively in the classroom, as ICTs have a positive effect on learning outcomes. This inculcates skills required in the networked and knowledge-based society.

2.7. TEACHER SUPPORT STRUCTURES IN ICT

In the last two decades, governments and educators all around the world have recognised the exceptional promise of ICT to foster teaching and learning in primary schools (OECD, 2015:24). However, it is important to note that for ICT to enhance teaching and learning, it needs to be supported by education and school policies and effective professional development for teachers (UNESCO, 2012:22). The process of integration of ICT into classroom teaching is a complex one that calls for changes in various aspects of the learning environment. A stated by Lim (2014:55-57), in a study on the integration of ICT in Singaporean schools, the key teacher support structures may include issues related to classroom management, availability of ICT tools, establishment of disciplinary and educational rules, division of labour among teachers, teacher assistants and students and revised school policies.

It is vital for policy-makers and administrators in schools to put in place support structures to effectively solve the challenges experienced by teachers in order for ICT to be successfully integrated into the classroom. The OECD (2015:66) stated that a sound school policy related to ICT integration like the availability of an ICT plan, ICT support mechanism for teachers and ICT training to enhance the skills of teachers has a significant effect on classroom use of ICT by teachers.

There is a need for planners at the national level to devise policies geared towards the creation of a shared vision and mission of ICT integration, especially with teachers. Building of requisite physical and technological infrastructure will go a long way to achieving the objective of integration of ICT into the existing teacher methodologies and providing the necessary training on ICT skills. Lim (2014:56) concurred with this proposition by calling for the establishment of ICT competency standards for teachers as a potential support system and as an effective tool for ICT integration into teaching and learning.

Apart from the presence of essential and sufficient ICT infrastructure for teachers, there is a need for schools to employ technical assistants and coordinators to maintain systems and ensure that the infrastructure remains compatible with developments in software and update teachers with current ICT skills (UNESCO, 2012:22). The role of technical assistants is to assist in the optimal maintenance of ICT equipment while ICT coordinators' work is to ensure access to up-to-date materials with innovations in the ICT field, to decide the direction of ICT

use in their schools, and to organise in-school training for teachers (UNESCO, 2012:22). Through planning, allocating resources and budget and giving technical and curriculum support, such coordinators lead the community of teachers in the implementation of ICT-based teaching.

Appropriate curriculum goals and national policies need to be developed by the education authorities followed by implementation at the school level by teachers (OECD, 2015:66). Vanderlinde and van Braak (2011:38) concurred with this assertion by suggesting that requisite and essential conditions for ICT policy implementation in schools are visibly successful where ideal communication involving educational policy officials and teachers is concerned. Further, the presence of consistent information provided to schools and teachers especially aimed at explaining the general ICT policy at the school-level is vital for articulated integration of ICT. Notably, there is a possibility of the national ICT curriculum being incongruent with the school's ICT policy, especially where the voice of the teacher is not taken into account. This scenario may present challenges in the process of ICT integration in the school curriculum. UNESCO (2015:33) suggested that, to overcome this barrier, there is a need for schools to give the necessary attention to the process of planning of the ICT curriculum across the school; the strategies to redirect education practices; access to courseware for ICT integration within the curriculum; and opportunities for professional development of teachers.

In a study on ICT-in-Education in sub-Saharan Africa, UNESCO (2015:34-36) suggested that professional development is needed for all school teachers to support the process of ICT integration in schools. Teachers' competencies are of special importance. ICT professional development for teachers can be inadequate because the computer is traditionally often considered as a simple mechanism for delivery of course content but not a mediation tool. This has led to situations where the use of ICT becomes limited by the course design itself.

In addition, Taban et al. (2013:3) in a study on difficulties faced by teachers in using ICT in teaching-learning in Uganda suggested that solutions to effective use of ICT by teachers include encouragement to focus on outcomes that can be evaluated; provision of a practical introduction to educational theories; development of project-based professional development where teachers plan students' activities in the course and provision of necessary ICT skills. Taban et al. (2013:2) are cognisant of the fact that although professional development programmes are usually designed by academic educators, actual changes in pedagogical

content knowledge start from teachers' perspectives and require teacher ownership, and there is a need for teachers' support and consideration in the entire process of ICT integration.

It is necessary for the ICT policy at the national and school levels to be localised to the teacher's context through the development of requisite professional development programmes as a teacher-support tool. Although both governments and school officials play a role in fostering ICT-in-Education, the ultimate realisation of the strategy relies on teachers' ICT skills and their intentions for ICT use. A challenge in primary schools especially in developing countries like Kenya is the issue of limitations in the available ICT resources coupled with the limited technical and pedagogical skills of teachers. A localised ICT package for teachers will act as a solution to this challenge. Tailor-made ICT professional development needs for teachers should take into account the types of ICT resources available to teachers in school, and allow choice and guidance where it is needed by teachers who have different degrees of ICT literacy and different disciplinary expertise.

Another challenge as articulated by Park (2016:2) is the absence of consideration of pedagogy for using ICT. The importance of focusing on pedagogy more than on technology and innovation in teaching styles when building teachers' ICT competencies is crucial for teacher support in ICT integration. One example of such innovative teaching practices is to have teachers engage in online forums during professional development. This can facilitate the development of ICT teaching and create teacher online communities which can foster both critical discussion and collegiality (Prestridge, 2012:43).

Various scholars have studied teacher support structures in ICT integration giving many findings and suggestions. Motsi and Ramorola (2016:485) investigated factors that are likely to motivate teachers to use ICT-based in-service training (INSET) programmes to enhance their professional skill development. A survey was conducted among primary-school teachers and the sample consisted of 82 respondents in Tshwane South District in Gauteng Province. From the identified factors, a model for ICT-based professional skill development for school teachers was developed. By reviewing the literature, these factors were established and were used in the development of the research model. A closed-ended questionnaire was used to collect data, and thereafter the data was analysed. The findings showed that the proposed model of ICT integration had a 60.9% success rate especially with the supported development of ICT

professional skills for teachers in primary schools. From this study, it is reasonable to state that teacher support in ICT skill development is essential for effective ICT development.

In support of the same sentiments, Motene's (2016:58-59) study aimed at designing and developing ICT instructional tools which were to be used to train teachers in primary schools on how to integrate ICT into teaching and learning. Design research and instructional design theories were employed in guiding this study. The study used the ADDIE model of instructional design as a guiding principle in the design and development of the tools. The participants were 28 teachers from three primary schools. The study revealed that capacitation of teachers requires laying a foundation for ICT integration into teaching and learning. Giving computers to schools can lead to successful integration once the teachers feel competent to use them. Furthermore, it is crucial that other intervention strategies to empower teachers be explored. Notably, professional support in the development of ICT skills for teachers is a major catalyst for the effective acquisition of ICT skills for the overall integration process.

On the other hand, Mwambene and Luneta (2015:4) highlighted factors that influenced the integration of ICT in Malawian college mathematics classrooms. The findings showed that, despite the identified and evidence-based positive attributes of ICT in enhancing mathematical learning and teaching, teachers were still using chalk-and-board teaching because of several barriers which hinder the integration of ICT in the mathematics classroom. The findings also revealed that all stakeholders concerned with ICT integration should pay much attention to factors and barriers that hinder ICT integration in college mathematics classrooms to find possible solutions to these challenges.

2.8. EFFECTIVENESS OF TEACHERS' SUPPORT STRUCTURE FOR ICT INTEGRATION

Previous research (Msila, 2015:19-26; Ndibalema, 2014:11, Ouma et al., 2013:2; Tedla, 2012:202) found that ICT is highly regarded as an effective pedagogical tool to transform teaching and learning and help all learners to achieve their learning potential and for meeting the 21st-century skills. The uptake and appropriation of ICTs in schools by teachers are determined by several factors which include staff development in terms of empowering them with technological skills, affording them new methods of teaching, collaborative working,

access to the internet and other ICT tools, interaction with learners, self-motivation, positive attitude and support from the school leadership (Ouma, et al., 2013:1; Tedla, 2012:202).

All stated factors that contribute to ICT use in teaching and learning are conditions that are a reality in teaching and learning contexts. Adequate awareness of the potential of ICT in teaching and learning is a prerequisite to making teachers aware of conditions at their disposal that can lead to the effective use of ICTs in the educational situation. However, ICT use in many schools is hampered by several conditions which are illustrated in the next section.

The same sentiment is fronted by Taban et al. (2013:1-3) study that aimed at finding out the difficulties faced by teachers in using ICT in classroom teaching-learning in technical and higher educational institutions in Uganda. The effective use of ICT by the teachers in the classroom was found to be very important in providing opportunities for learners to learn to operate in an information age. Studying the obstacles to the use of ICT in educational institutions may assist teachers to overcome these barriers and become successful technology adopters in the future. The findings of this study further revealed that teachers had a strong desire to integrate ICT into the teaching-learning process even though with difficulties. The major barriers to the effectiveness of the teacher support were lack of genuine software, inadequate computer in the classroom, low-speed internet, lack of motivation from both teacher and student side to use ICT, lack of proper training skills, unavailability of latest ICT equipment, lack of expert technical staff, poor administrative support, poor course curriculum etc.

Suggestions were also made for ongoing professional development of teachers to model new pedagogies and tools for learning to enhance the teaching-learning process. Similarly, Mukhari (2016:23) researched South African teachers' experience in using ICT in the urban schooling system. Their study was underpinned by the network society theoretical framework with the research method as a qualitative interpretative approach and data collection methods included a literature study, non-participant observation and semi-structured interviews with a purposefully selected sample of teachers and school principals and analysis of documents on ICTs in teaching and learning. Findings indicated that the effectiveness of ICT integration in teaching and learning is endorsed by teachers and principals who understand the benefits of ICT in enabling better methodological strategies, greater collaboration among teachers, improved access to the required information and the ability to cater for learners with different potential and learning styles.

However, several factors that hinder the effectiveness of the ICT integration in urban schools were identified as inadequate ICT infrastructure, teachers' lack of ICT skills and low level of ICT support for teachers, inadequate training, negative attitudes and poor teacher confidence. Other factors included lack of ICT leadership, funds and technical support for teachers. The ultimate goal of this study was to analyse factors that both hinder and enable the effectiveness of the integration of ICTs into teaching practice in South Africa and to contribute to the body of literature on ICT integration in South African urban schools. Additionally, though the focus was on the integration of ICT, the study focused on urban schools unlike in the current study where both rural peri-urban and urban schools were targeted.

In Kenya, learning institutions are under increasing pressure to integrate ICT in teaching and learning given the knowledge and skills needed in the 21st century (MOEST, 2012:11). Despite this, the challenge confronting the educational system is how to transform the curriculum, teaching and learning process to provide teachers with the skills to function effectively in this digital era. Even though the teachers' initial anxiety of getting involved with technology may be overcome, serious challenges remain in terms of providing enough technical support. However, teachers will not be discouraged by equipment failure that they do not understand (Omariba et al., 2016:203).

2.9. GAPS IN TEACHER SUPPORT NEEDS FOR ICT INTEGRATION

Various scholars have identified the gaps existing in teachers' support for ICT integration in schools. Some of the gaps include school-level barriers and institutional and personal factors hindering effective implementation of ICT in schools.

2.9.1. School-Level Barriers

Greer, Koran and White (2016:20-22) stated that lack of instructional time, lack of access to ICT resources, inadequate ICT infrastructure, lack of effective training, inappropriate organisation, technical problems, lack of vision and mission about the significance of ICT in teaching and learning and poor leadership are characterised as school-level barriers. Although all these variables affect the integration of ICTs in teaching and learning, it is teacher-related characteristics that outweigh school characteristics as they are said to be an important influence

on the uptake of technology to enhance teaching and learning. This is based on the assumption that teachers are key figures in determining the successful use of ICT in the learning milieu. Hart and Laher (2015:2) have identified barriers which include lack of access to computers in schools, lack of software and technical support for teachers, insufficient teacher training, lack of internet access, lack of reliable electricity supply and lack of parent and community involvement as key in the use of ICT in schools in developing continents such as South America and Africa.

Similar findings were expressed by Sipilä (2014:238) regarding ICT use in Finnish schools where he maintained ICT integration and use in teaching and learning is not yet at the level it should be. This state of affairs has arisen because some Finnish teachers do not have the necessary digital literacy and do not know how to integrate ICT into their teaching strategies and learning methods. This is problematic in that the schools in Finland do not know what to do as institutions (Sipilä, 2014:238). From these findings, it can be inferred that schools lack ICT policies and vision, have insufficient ICT skills and the school leadership lacks vision in terms of ICT integration in teaching methodologies and its value in education.

2.9.2. Institutional and Personal Factors

2.9.2.1. Institutional Factors

Ahmed (2015:18) stated that the two broad categories of negative factors that may hinder the use of ICT in classrooms are institutional and personal factors. Brun and Hinostroza (2014:33) added that some of these institutional barriers are lack of effective and continuing leadership training for school managers and teachers; insufficient digital learning resources; insufficient pedagogical support; lack of institutional policies for ICT integration; insufficient ICT equipment; insufficient connection/access speed to the internet; lack of institutional interest on ICT integration; lack of practical/technical support; lack of integration of ICT into all levels of teacher education; and lack of establishment of a community of practice among practitioners in ICT-related activities.

2.9.2.2.   Personal Factors

Hamdane, Khaldi and Bouzinab (2013:45) argued that some of the problems that fall under personal barriers are lack of time to prepare ICT materials for lessons; lack of teachers' pedagogical ICT-related competencies; lack of teachers' confidence to try new approaches; lack of teachers' competences to identify useful ICT tools; and lack of teachers' flexibility to integrate ICT. Research studies (MacCallum, Jeffrey & Kinshuk, 2014:150; Mooeketsi & Chigona, 2014:7) have posited that teachers are either under-utilising ICT or not implementing ICTs at all in their teaching, and have provided reasons why teachers are reluctant to use ICTs. MacCallum et al. (2014:144) postulated that beliefs held by teachers, ICT anxiety and lack of digital literacy impact the integration of ICTs in teaching and learning situations. Chigona and Chigona (2010:3) highlighted that the reluctance to embrace and integrate ICT in the teaching and learning activities emanates from a lack of confidence among teachers in using ICT for teaching their subject content. These obstacles are evident because computers in many ICT resourced schools are 'white elephants' simply because school teachers do not know what to do with these tools (Mlitwa & Koranteng, 2013:9).

Ndlovu and Lawrence (2012:2) further reported that, because of these barriers, teachers did not use ICTs to their fullest potential to transform their traditional pedagogical practices. If the perceived value of ICT integration is not clear to teachers, they are likely to continue using conventional methods. Additionally, some teachers are not impressed with the implementation of computers since activities such as shared group reading in class and hands-on experience in practical science lessons are better dealt with through traditional teaching methods.

2.10.   SUSTAINABILITY OF TEACHERS' INTEREST AND SKILLS IN ICT USE

Many factors are pointed out by several authors as discussed in this sections. The strategies to sustain teachers' interest and skills in ICT use are derived from the gaps identified and how they can be mitigated at school, institution and personal level.

UNESCO (2012:7) attributed the problem to lack of communication and leadership between macro-, meso- and micro levels in education. This lack of communication leads to limited

access to ICTs in schools; problems with aligning ICT-enhanced learning environments with the curriculum; a lack of a shared vision at the school level and insufficient ICT pedagogical competencies of teachers. Omariba and Iraki (2014:3) contended that challenges that prevent schools from using computers as teaching and learning tools in Kenya include lack of teacher confidence, lack of teacher competence, resistance to change, and negative attitudes which are teacher-level barriers. Omariba and Iraki further identified a lack of proper training in the use of ICTs and preparedness for the integration of ICTs as a barrier to the integration process.

Under school-level barriers, Greer et al. (2016:2050) cited lack of time, lack of effective training and lack of support as external issues preventing teachers from integrating and implementing ICTs. Tonui, Kerich and Koross (2016:15) cited inadequate equipment, lack of technical and administrative support, inappropriate attitudes and inadequate training of teachers as barriers to effective integration of ICT in schools in Kenya. Other notable challenges include unavailability of power, infrastructure, computers, lack of procedures for monitoring and evaluating ICT use and inadequate capacity building of teachers.

2.11.   THEORETICAL FRAMEWORK

Underpinning theories in this study are the Network Society Theory and Diffusion Innovation Theory. These theories are examined in terms of teacher support structures in ICT use. A comparison and critique of the theories is done to ascertain whether they are relevant to the teachers' support structures in the integration of ICT in basic education.

2.11.1. Network Society Theory

Network Society Theory is a social theory that focuses on social organisation and the role ICTs play in transforming teaching and learning in the schooling system (Wildemeersch & Jütte, 2016:2). The first proponent and advocate of the Network Society theory was Castells (1999:1). Castell maintained that a new social order began towards the end of the 20th century as a result of the information technology revolution and the use of ICTs in all spheres of life. Network Society Theory emphasises the importance of knowledge and highly educated individuals who could contribute to the success of organisations, societies and nations.

Network Society Theory endorses the formation of network communities, platforms, and the use of ICTs to acquire, share and distribute knowledge to everybody all over the world. Availability of knowledge to all, anywhere and at any time was mooted by Selwyn (2012:87) with his notion of ICT development and the different routes that lead to different technological outcomes. In addition, Levinsen (2011) asserted that communities are no longer limited to neighbourhoods because social networks provide ways in which people can use these new ties to access resources. As indicated by Castells (2000:350), these networks ensure the social inclusion of people into global networks for the accumulation and the flow of information.

Castells' Network Society Theory emphasises the new social structure of which ICTs are an inextricable part. These ICTs are vehicles used to transfer knowledge to empower people with skills for personal, social and economic growth. According to Castells (2007:14), knowledge is associated with power and wealth enabling individuals and nations to be joint actors in the global arena. This was further confirmed by Butcher (2011:13) who stated that knowledge is one of the pillars essential for the realisation of a knowledge-based society by producing learners and citizens with high order skills who know how to participate in a globalised community.

The role of ICTs, especially the internet, is therefore intended to disseminate knowledge, information and power to make people knowledgeable and better human beings and to make the world they live in a better place. Castells and Cardoso (2005:4) and Levinsen (2011:52) argued that for society to survive in the networked society, it must have a self-directed labour force of highly educated people who are creative problem-solvers, critical thinkers, leaders, knowledge constructors and collaborators. These are the knowledgeable and digitally competent people who will be responsible for expanding the economies of their respective countries. From this assertion, it can be inferred that countries with educational systems that subscribe to the Network Society Theory are obliged to develop curricula that focus on education that produces self-directed learners. The Network Society Theory is relevant to this study because the effective use of network platforms results in the professional development and support of teachers who have to develop digital literacy and engage in lifelong learning to produce self-motivated and self-directed learners.

The Network Society Theory emphasises learning using ICTs and various strategies to acquire knowledge to empower the members of society. However, some barriers inhibit the development of the network society. These barriers are poverty-related issues that render network use impossible for some nations like Kenya. Since the mode of development in a network society is technological and depends on knowledgeable individuals for social and economic growth, the notion of the network society is difficult to achieve in developing and third world countries like Kenya because of poverty and lack of access to new technological tools. As affirmed by Tonui et al. (2016:12), only 17% of teachers in primary schools in Kenya have been trained on proper implementation of ICT-in-Education due to scarcity of ICT resources like the internet and computers.

The access to and use of ICTs are defined as empowering and democratic since technology is considered one of the greatest enablers for improved quality of life. However, the majority of African teachers and learners are unable to realise the status of being powerful due to inadequate ICT skills. Omariba et al. (2016:200-201) confirmed this by arguing that primary-school teachers are incompetent in the integration of ICT in teaching methodologies and are not fully trained on the computer or other ICTs.

2.11.2. Diffusion of Innovation Theory

The first proponent of the theory of Diffusion of Innovation (DOI) was Roger in 1983. According to Rogers (1983:11), diffusion is the process where innovation is transmitted through a given medium or channels through time and often to the members within a given social system. Additionally, Rogers argued that an innovation may be an idea or object that is perceived as new by people or within its line of adoption. Innovation is brought about by interaction between the members of a social system involving the creation and sharing of ideas and information to get into a mutual consensus. Robson, Haugh and Obeng (2009) added that diffusion of innovations theory takes a radically different approach to most other theories of change. Instead of focusing on persuading individuals to change, it sees change as being primarily about the evolution or 'reinvention' of products and behaviours, so they become better fits for the needs of individuals and groups.

In the diffusion of innovations, it is not people who change but the innovations themselves. According to Rogers (1983), the characteristics of innovation, as perceived by the members of a social system, determine its rate of adoption. The innovation-diffusion theory states that an innovation (technology) is passed on from its source to end-users through agents and its diffusion among potential users is for the most part dependent on the personal attributes of the individual user. The theory assumes that the technology in question is appropriate for use unless hindered by the lack of effective communication (Negatu and Parikh, 1999:208).

According to Rogers (1983), the four major factors that influence the diffusion process include the innovation itself, communication, time and the nature of the social system into which the technology is being introduced. Van Akkeren and Harker (2003:205) argued that media and interpersonal contacts provide information that influences a person's opinion and judgement. The theory comprises four elements: invention, diffusion through the social networks, time and consequences. Information filters through the networks and depending on the nature of the networks and the roles of its opinion leaders, innovations are either adopted or rejected.

Rogers further claims that the five adopter categories are innovators, early adopters, early majority, late majority and laggards. Interestingly, the five categories follow a standard deviation curve where very few innovators adopt at the beginning (2.5%), early adopters constituting 13.5%, the early majority constituting 34%, the late majority another 34%, finally the laggards at 16% (Nchunge, Sakwa & Mwangi, 2012). Rogers (1983) also described the main elements in the diffusion of new ideas as follows: innovation, communication, time and existence of members of a social system.

2.11.2.1. Innovation

Rogers (1983) identified five characteristics for successful adoption within the theory of DOI: relative advantage, complexity, compatibility, trialability, observability. Tornatzky and Klein (1982:55) singled out relative advantage, compatibility and complexity to have consistent significance in technology adoption. Rogers (1983:212) further defined relative advantage as the extent to which a new idea is seen as better than the idea in use before its introduction. He also defined compatibility as "the extent to which an innovation is seen as being compatible with the existing values, experience, and needs of potential adopters" (Rogers, 1983:223).

Finally, he defined complexity as "the extent to which an innovation is seen as difficult to understand and use" (Rogers 1983:230).

2.11.2.2. Communication

Communication is the process by which participants create and share information to reach a mutual understanding. A communication channel is the means by which messages get from one individual to another. Mass media channels are more effective in creating knowledge regarding innovations, whereas interpersonal channels are more effective in forming and changing attitudes toward a new idea, and thus in influencing the decision to adopt or reject an original idea. Communication between teachers and learners, among teachers, and among learners is one of the key tools in implementing ICT-in-Education. There should be standard ICT platforms for supporting teachers to share their thoughts and also for other stakeholders related to education to offer the requisite support.

2.11.2.3. Time

An individual seeks information at various stages in the innovation-decision process to decrease uncertainty about the consequences of using an innovation. The innovation becomes matured and blended over time. Time has several elements that include:

Knowledge – a person becomes aware of an innovation and has some idea of how it functions;

Persuasion – person forms a favourable or unfavourable attitude toward the innovation;

Decision – a person engages in activities that lead to a choice to adopt or reject the innovation;

Implementation – a person puts innovation to use and

Confirmation – a person evaluates the results of an innovation-decision already made.

Integration of ICT in Kenyan basic education has to be accepted by the teachers for sustained and successive use. If teachers can acquire knowledge about the process and they understand the benefits, they will be able to decide to use it as their medium of instruction. They will develop new ideas on how to use it and will make efficient of technology in their teaching. To effectively accomplish this task, teachers require support with relevant ICT facilities from the stakeholders.

2.11.2.4. Social system or members

The fourth essential element in the diffusion of new ideas is the social system. A social network is defined as a set of interrelated units that are engaged in joint problem-solving to accomplish a common goal. The members or units of a social system may be individuals, informal groups, organisations or subsystems. The social network constitutes a boundary within which an innovation diffuses. Since the integration of ICT in basic education is a recent development in Kenya, it may take some time to change the mindset of the teachers on the necessity of abandoning traditional methods in teaching-learning and acquiring learner-centred ones. This is possible with the support of teachers in ICT integration by the stakeholders through the elimination of the barriers that inhibit the whole process. The DOI theory is relevant in this study since it advocates for the cascading of innovation from the highest to the lowest level of society. This study supports the concept of diffusion of ICT integration in primary schools from the teachers to the learners. The barrier inhibiting the smooth diffusion of the ICT process specifically with regard to the teacher support is the concern of the study.

2.11.2.5. Critique of diffusion of innovation theory on teacher support in ICT integration

Rogers (1983:223) argued that an innovation may be an idea or an object that is perceived as new by people or within its line of adoption. Roger believed that new ideas would automatically be acceptable by all people. However, in the process of integration of ICT in basic education in Kenya, teachers have been hesitant in abandoning traditional teacher-centred methodologies for the new learner-centred approaches. As ascertained by Tonui et al. (2016:12), teachers fear the complexities of the concept of ICT which is ingrained in their mindsets.

2.12.   SUMMARY OF THE CHAPTER

This chapter presents a literature review of the efforts towards teacher support to integrate ICT in primary schools learning environment. A review of ICT-in-education comparing global and regional approaches was also presented in this chapter. It also provided details of the literature on the existing teacher support structures in Kenya. It also discussed the theoretical framework underpinning this study. The theories discussed are the Network Society Theory and the Diffusion of Innovation theories and provided a critique of each theory. From the literature reviewed, it is evident that there is an attempt by the MOE to address the need for teacher capacity in ICT. This is evident in the various policy instruments that clearly spell out the need for ICT-integration training for teachers. However, there is need for the government to ensure that these policies are aligned with on-ground implementation of the support to teachers. The following chapter focuses on the research methodology that the study was anchored on.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1. INTRODUCTION

This chapter gives an overview of the methodology used to conduct this study. It presents the research paradigm, research approach, research design, the target population sampled, data collection strategies used and explains how the collected data was analysed. The chapter also address the reliability and validity of the instruments as well as the ethical issues and measures that ensured trustworthiness of the study's data.

3.2. RESEARCH PARADIGM

A research paradigm represents the fundamental assumptions and practices that influence how to conduct a research project as a way of shaping and understanding the phenomenon (Creswell, 2014:19). This study is underpinned by the interpretive epistemological paradigm. Researchers who take this stance seek to understand the world they live and work in (Creswell, 2014:18). They develop subjective meanings of their experiences with certain phenomena (Wahyuni, 2012:70). The understanding of the phenomenon is achieved through the direct interaction between the researcher and the participants (Wahyuni, 2012:70). Furthermore, such researchers tend to rely heavily on the participants' views of the phenomenon under investigation (Creswell, 2014:18).

McMillan and Schumacher (2010:5) identified positivism, interpretivism and critical theory as the basic research paradigms which researchers bring to research. According to these authors and Nieuwenhuis (2007:55), positivism emphasises a rational view of knowledge that can be discovered only through scientific methods. This paradigm maintains that humans must be studied in the same way as nature is studied and as such, scientific knowledge is regarded as fact. The emphasis on a single reality, however, results in disregarding social interaction as a source of knowledge construction. In the critical paradigm, people understand how society functions and the methods by which unsatisfactory aspects can be changed. Interpretivism stands in opposition to positivism and maintains that there are many truths and multiple realities

because external reality is variable. The interpretivist approach provides the participants with the opportunity to raise their voices, concerns and practices to be heard and at the same time enables the researchers to get insight and in-depth information (Thanh & Thanh, 2015:26).

Critical theory shares characteristics with interpretivism by focusing on studying and understanding society but it puts more emphasis on reason as the highest potential in human beings. Through reasoning people are enabled to criticise, challenge and change the nature of society (De Vos et al., 2011:9). The network society theoretical framework which underpins this study is a critical theory in that it highlights the weaknesses of the schooling system in Kenya which for a long time relied on a teacher-centred approach, traditional pedagogic methods, and educational outcomes which focused on producing passive learners. In contrast, critical theory advocates a change in the schooling system that embraces ICT integration across the curriculum to produce active, creative, critical thinkers and problem-solvers with ICT skills required for personal, social and economic growth in the globalised world.

This study is rooted in the interpretivist paradigm as it is more concerned about uncovering and explaining teachers' support structures on ICT use in teaching and learning in the school environment in Kenya than conducting a scientific experiment. The study subscribed to the critical approach in that it challenged and critiqued the current schooling system in which the MOE and school leaders do not embrace effective teacher support strategies in ICT to enable the transformation of the teaching and learning process for the foundation of new knowledge and the establishment and realisation of the knowledge society.

In terms of this study, primary-school teachers' support structures for effective implementation of ICT in Kenya primary schools were better understood through direct interaction with participants at school. To effectively perform this task, teachers' views and experiences on existing support structures, the effectiveness of the support structures, and gaps in teacher support needs and ways of sustaining teachers' interest and skills in ICT use were obtained through data collection.

3.3. RESEARCH APPROACH

According to Yin (2009:26), a research approach refers to a logical plan for constructing the initial set of questions to be answered in a research study, and consequently generating the answers to the questions stated. Additionally, Tuli (2010:102) defined methodology as a research strategy capable of translating ontological and epistemological assumptions into guidelines that dictate the way research is to be approached. McMillan and Schumacher (2010:21) also defined methodology as the procedures used in conducting a study.

The nature of the research problem dictates the research methodology which the researcher must use to obtain the information to answer the main research questions and the sub-questions. The research purpose can be achieved by using any of the three research approaches typified by McMillan and Schumacher (2010:11) and Welman, Kruger and Mitchell (2013:34) as follows:

A quantitative approach emphasises objectivity in measuring and describing a phenomenon. In this inquiry, the quantitative researcher follows a logical model in which specific expectations according to the hypothesis formulated are developed. The focus is on numerical data rather than the views and utterances made by the research participants.

A qualitative approach focuses on non-numerical data and the researcher focuses on establishing the meaning of a phenomenon by using the participants' narratives, experiences and views.

A mixed-method approach combines quantitative and qualitative methods to produce a more comprehensive investigation. One of the advantages of employing a mixed-method approach is that the researcher demonstrates the findings statistically using quantitative techniques and illuminates in words the results' context using qualitative techniques. The study used a mixed-method approach since quantitative and qualitative data was collected from the participant's views and experiences on teacher support in ICT use in primary schools. The use of this approach enabled the researcher to complement the weaknesses of the quantitative and qualitative approaches.

3.4. RESEARCH DESIGN

A research design is a logical blueprint or plan that is used by a researcher to address the intended research questions (Sekaran & Bougie, 2016:74). In other words, a design in a study is like a pathway that a researcher pursues until a predetermined destination is reached. Yin (2010:75) further emphasised that the logic in the design assists to strengthen the validity and the accuracy of a study. For the study, the logic involves the links between the research questions, the data to be collected and the strategies for analysing the data so that the study's findings address the intended research questions (Yin, 2010:76).

In addition, Creswell (2014:11) emphasised that the researcher is expected to explain and justify the choice of the research design and how it is employed. The researcher should be properly conversant with the methodology and accountable for every step that is taken throughout the implementation of the research plan. A concurrent transformative research design was adopted in this study. A mixed-method approach, encompassing both quantitative and qualitative data collected concurrently was further followed by more in-depth qualitative data which was later integrated into the findings at the analysis stage.

3.4.1. Mixed-Method

Combining quantitative and qualitative methods within a single study in the social sciences enables a study to make the most use of an integrated system of research design that deploys a systematic and rigorous investigation to address a specific problem resulting from a knowledge gap (Creswell, 2012:535). This study adopted a mixed methods research design with an explanatory concurrent and at the same time sequential approach. Mixed methods research design largely includes complementarily fusing both qualitative and quantitative research strategies, processes, procedures, principles and languages into a single study. For this study, the findings from qualitative approaches were used in the same or subsequent phases of the overall study to establish quantitative research questions, scales and ideas.

3.4.2. Quantitative Research Approach

In this context, I followed a logical model in which hypotheses were formulated. The focus was on gathering numerical data through questionnaires answered by the teachers on the

support structures for ICT integration in practical use in schools. Documentary reviews from school records related to support given to teachers on ICT integration in schools were also used to assist in the acquisition of quantitative data.

Zikmund, D'Alessandro, Winzar, Lowe and Babin (2016:89) stated that a quantitative research approach affirms the importance of imitating the natural sciences associated with what should be regarded as acceptable knowledge in a discipline. It entails the collection of data that can be quantified to exhibit the relationship between theory and the research as deductive (Bryman & Bell, 2011:154). Additionally, the quantitative research approach emphasises objectivity in measuring and describing each parameter.

3.4.3. Qualitative Research Approach

Qualitative data was obtained from in-school observation and recording the views, experiences and reflections of the head-teachers during the fieldwork process of data collection. It was important that the study captured the knowledge, views and experiences of the head-teachers (key informants) on the support structures provided to the teachers by the MOE for the eventual transformation of the teaching and learning process from teacher-centred to learner-centred through the integration of ICT in the curriculum. Existing Policy Documents were also included as part of the data-source.

Welman, Kruger and Mitchell (2013:35) suggested that the qualitative research approach is applicable whenever the researcher intends to gain in-depth knowledge of the phenomenon under study. Creswell (2014:17) added that the intention of a researcher in the adoption of a qualitative research approach is to understand the reality of the experiences of individuals about given problems existing in their own environment. McMillan and Schumacher (2010:322) provided a different perspective about the use of a qualitative research approach; they stated that in qualitative research, a researcher enters the natural setting assuming that nothing is unimportant.

3.5. POPULATION AND SAMPLE

The population is defined as the large collection of all subjects from where a sample is drawn (Welman, Kruger & Mitchell, 2013:36). Creswell (2014:20) described the population as the total collection of subjects of research. Therefore, the study population is the total of the units from which the sample is aggregated. The focused elements in the sample of the study are called the target population representing the units that the study intends to use. The target population comprises the total number of subjects of interest to the researcher (Sekaran & Bougie, 2016:77).

De Vos et al. (2011:224) stated that a sample refers to the subset of the population included in the study. Sampling involves the selection of information-rich cases to undertake an in-depth study to familiarise the researcher with the internal nature of the problem under study, without the necessity for generalisation of all such cases (McMillan & Schumacher, 2010:325). Sampling refers to selecting some part of a group to represent the entire group or the population of interest.

Sampling reduces the length of time needed to complete a study; it cuts costs, is manageable, increases accuracy and is almost a mirror of the target population (Cooper & Schindler, 2014). Zikmund, D'Alessandro, Winzar, Lowe and Babin (2016:90) stated that there are two categories of sampling techniques, namely, probability and non-probability sampling techniques. With probability sampling, used in quantitative approaches, each element in the sample has an equal chance of selection for the requisite sample. A probability sampling technique involves a sample that has been selected using random selection so that each unit in the population has a known chance of being selected. A non-probability sampling technique, used in qualitative approaches, is a technique where a sample has not been selected using a random selection method. It implies that some units in the population are more likely to be selected than others.

Two probability sampling techniques were used in this study; stratified and proportionate stratified sampling. In stratified sampling, the universe is divided into several sub-groups of the population that are individually more homogeneous than the total population (the sub-populations differences are called strata). Items are then selected from each stratum to generate

a sample, ending up with each stratum being more homogeneous. Stratified sampling gives more reliable and detailed information about the population. The determination of the strata depends on the experienced and informed judgement of a researcher. Proportionate stratified sampling is a sub-type of stratified sampling and it is applied when the proportion of the units randomly selected from each stratum is the same as the proportion of the population (Cooper & Schindler, 2014).

This study used the probability sampling techniques as follows: first, stratified sampling was used to divide the population into four strata, according to the four selected Kenya counties of Kajiado, Kilifi, Nairobi and Uasin Gishu. There was a total of 604 primary schools and 3 400 primary-school teachers in the four counties. There are 60 sub-countries in the four selected counties. Secondly, proportionate stratified sampling was used to select representative samples of participants from the schools in the four counties.

Kerlinger (1983) stated that 10-30% of any homogenous group is sufficient to constitute an appropriate scientific representation of the study population. To this effect, six sub-counties which represented 10% of the sample were selected. In addition, from the six sub-counties, 10% of the teachers were selected to constitute a total of 340 teachers as respondents.

In this study, purposive sampling was used to select the participants for the qualitative aspect of the study. They were chosen since they had the requisite knowledge and information about the problem under study. In the context of this study, purposive sampling was applied in selecting the research participants to provide the requisite information because primary schools in Kenya have been the focus of ICT integration as the basis for cascading ICT knowledge through the entire education sector. From each sub-county, two head-teachers were selected to constitute a sample of 12 respondents for the interview schedules for the purpose of a deep dive into the subject of this research. The final combined sample size was 352 respondents.

A sample size refers to the number of items to be selected from the universe to constitute a sample (Creswell, 2014:20). The sample size is an important feature of any empirical study in which the goal is to make inferences about a population from a sample. In practice, the sample size used in a study is determined based on the expense of data collection, and the need to have sufficient statistical power (Creswell, 2014:21). According to Saunders, Lewis and Thornhill (2012:66), a more representative sample size is characterised by a precise error margin of

between 1% and 5%. This margin of error allows for generalisation. The sample size for this study was determined using the Yamane (1967) formula, as follows: $n = \frac{N}{1+N(e)^2}$

Where:

n is the sample size

N is the population size – 3400

E is the margin of error – 5%.

Thus:n $= \frac{3,400}{1+3,400\ (0.05)^2} = 352$

The sample size was thus comprised of 352 respondents.

Table 3.1: Sample distribution

County	No. of teachers	Proportion	Sample size
Kilifi	486	$\frac{486}{3400} \times 352 = 51.17$	50.3
Uasin Gishu	730	$\frac{730}{3400} \times 352 = 76.86$	75.6
Kajiado	505	$\frac{505}{3400} \times 352 = 53.17$	52.3
Nairobi	1,679	$\frac{1679}{3400} \times 352 = 176.78$	173.8
Total	3 400		352

3.6. DATA COLLECTION

Through the various explanations and descriptions of participants on the state of the problem in the study, insight and knowledge was gained by extracting credible answers to the research questions. Through the various strategies of gathering information from the participants like use of questionnaires, interview schedules, key informants and document reviews, I obtained invaluable information regarding the problem under review (Nieuwenhuis, 2007:81). In this study, questionnaires for primary-school teachers, semi-structured interview for head-teachers and document analysis formed the main data collection strategies.

3.6.1. Questionnaires

The first data collection strategy was the use of questionnaires to capture data from the primary-school teachers who were the key participants in the study. Kothari (2015) stated that a questionnaire allows the collection of data in a quick and efficient manner making it suitable for the collection of quantitative data. The questionnaire was chosen since, with it, it was easier to capture data from a large sample of participants selected in the four counties in a fast and cost-effective manner. The administration of the questionnaire assumed two approaches: (i) hard copies were issued to teachers in the school and were left for an agreed period of time after which they collected from the school; and (ii) the questionnaire was uploaded to an online survey platform, the survey link was sent to teachers on a mobile instant messaging platform, the teachers responded to questions online and feedback was relayed instantly. Two methods of administering the questionnaire were engaged in order to increase the number of respondents by providing two varied choices to pick from.

The questionnaire (Appendix 6) comprised of two parts: Section A collected data on the respondents' characteristics and demographics; and Section B covered questions thematically based on the research questions. Both open-ended and closed questions were used. A five-point Likert scale was used for closed questions which rated the respondents' answers on a scale of 1–5. The 2 scale ratings used were as follows: 1 = Strongly Disagree, 2 = Disagree, 3 = Moderately Agree, 4 = Agree and 5 = Strongly Agree; and 1 - Not at all 2 - Rarely   3 - sometimes   4 - Often   5- Always

3.6.2. Semi-Structured Interviews

The secondary data collection strategy used a semi-structured interview for head-teachers. The head-teachers were key informants for the in-depth interviews. The semi-structured interviews also provided in-depth comprehensive data that complemented the questionnaires. Head-teachers were asked the same questions (Appendix 7) with additional probing, clarifying and follow-up questions on support structures for teachers in ICT use in schools. This enabled the acquisition of more information in cases where the participants were reluctant to give full answers. An audio recorder was used to ensure that the interviews were captured appropriately and the written field notes in a journal were also critical datasets.

3.6.3. Document Analysis

The third data collection strategy was document analysis comprising of an evaluation of existing documents relating to support structures given to teachers on ICT integration. Through document review, I gained an understanding and an illumination of the deeper details of the phenomenon under study (De Vos et al., 2011:377). The use of document analysis provided insight in the trends of primary schools in Kenya on support provided to teachers with regard to ICT integration and the prevailing barriers. A further scrutiny of the content in the documents presented data for triangulation with other information obtained through the questionnaire and the interviews.

The documents for review included the ICT education policy documents available in schools, guidelines for schools ICT hardware specifications, newspaper articles and reports on ICT use in Kenyan primary schools. These documents, which were in public domain, were accessed from the websites of the MoICT, MOE and its affiliated agencies including the TSC and KICD.

3.7. DATA ANALYSIS

The data collected is analysed in order for researcher to unpack the information and to fully describe and attribute meaning to it with the intention of developing credible conclusions appropriate for answering the research questions. Data analysis employs strategies for in-depth understanding of the research questions raised, to ultimately achieve germane responses to these questions. Different techniques of analysis pertaining to the different research approaches of quantitative and qualitative engagement were employed.

3.7.1. The Data Analysis Plan
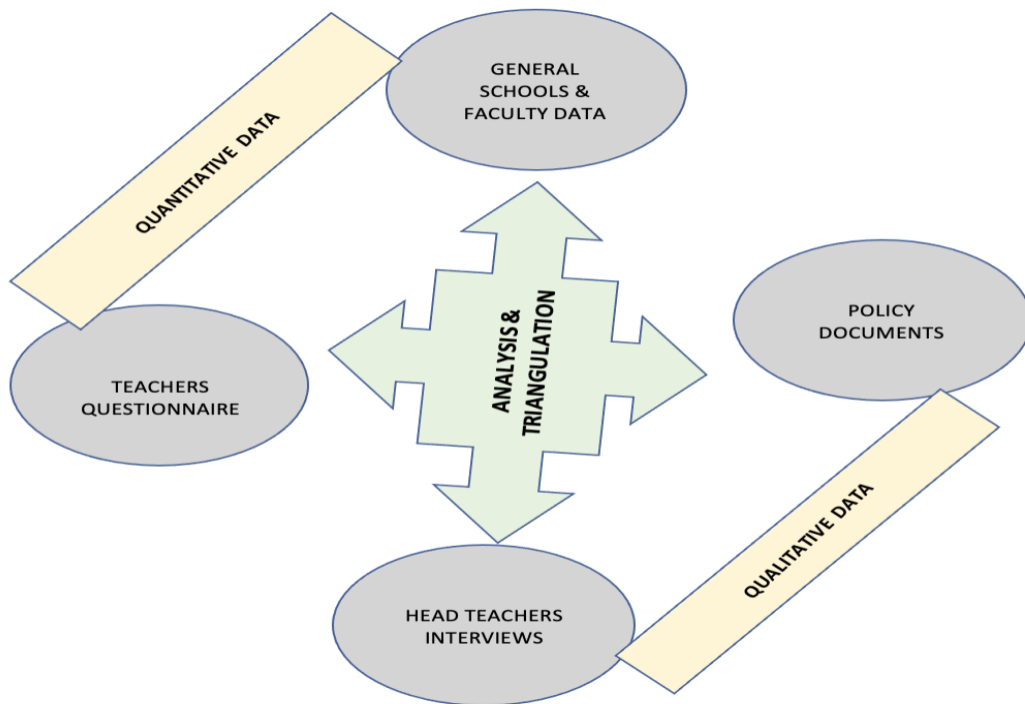
3.7.2. Quantitative Data Analysis

A linear regression through the use of descriptive and inferential statistics analysis was used to meet the objectives 1 and 2 of the study: to determine existing teacher support structures for teachers in Kenya primary schools; and to evaluate the effectiveness of teachers' support for ICT in teaching and learning being offered. Descriptive and inferential statistics were also used to describe the variables while showing the mean and standard deviation of use of the various strategies and the level of effectiveness. For research questions 3 and 4, (expressed gaps in teacher support needs for ICT; and sustenance of teacher interest and skills in ICT), descriptive and inferential statistics were used. The hypotheses (Section 1.7.2) were tested by means of ANOVAs (Creswell, 2014:64). Bivariate analysis was used to examine the association between the independent variable, teacher support structures and the dependent variable, effective implementation of ICT. In order to examine such an association, the Chi-square test (χ2) assisted in identifying factors that were significantly associated with teacher support structures.

3.7.3. Qualitative Data Analysis

Babbie (2007:378) defined qualitative data analysis as the non-numerical examination and interpretation of observations for the purpose of discovering underlying meanings and patterns of relationships. For this study, content, narratives and discourses obtained from the Head Teachers and which formed the qualitative data, were transcribed, categorized into themes, and analyzed thematically.

3.8. VALIDITY AND RELIABILITY TESTS

While measurement errors cannot be totally eliminated, it is critical that a researcher makes deliberate and conscious effort to minimize them. To this effect, this study addressed issues of validity and reliability in data collection instrument as explained in this section.

3.8.1. Validity Test

According to McMillan and Schumacher (2006:324), validity refers to the degree of congruence between the explanations of the phenomena and the realities of the world. According to Creswell (2014:78), validity refers to the accuracy of the definitions given to the concepts under investigation by the measures used whereas reliability is related to the stability of those measures. The validity of an instrument relates to the ability of the instrument to measure the construct as purported (Vogt, 2015:11). Vogt further stated that there are three main categories of validity tests; construct, content and face validity.

3.8.2. Construct validity

Construct validity was to measure whether the operational definition of variables actually reflected the true theoretical meaning of a concept. Construct validity refers to the extent to which operationalisation of a construct measures that construct as defined by a theory. Construct validity evidence involves the empirical and theoretical support for the interpretation of the construct (Kothari, 2015:77).

Such lines of evidence include statistical analyses of the internal structure of the test including the relationships between responses to different test items. They also include relationships between the test and measures of other constructs. For the purposes of this study, the

questionnaire was based on similar prior studies with modifications aimed at addressing the study objectives. Content validity was confirmed through the guidance of the expert opinion from the supervisor at Unisa. The supervisor's scrutiny and competent opinions ensured that the questionnaire covered all the study variables. He also double checked the document to ensure that the theoretical dimensions emerged as conceptualised.

3.8.3. Content validity

Content validity involves the systematic examination of the test content to determine whether it covers a representative sample of the variables to be measured (Cozby, 2014:64-65). Content validity evidence involves the degree to which the content of the test matches a content domain associated with the construct. The supervisor and other experts from Unisa reviewed the items covered in the instrument and commented on whether the items covered a representative sample of the behaviour domain.

3.8.4. Face validity

Face validity is an estimate of whether a test appears to measure a certain criterion; it does not guarantee that the test actually measures phenomena in that domain. Measures may have high validity, but when the test does not appear to be measuring what it is, it has low face validity. Indeed, when a test is subject to faking (malingering), low face validity might make the test appear more valid (Vogt, 2015:12). Considering one may get more honest answers with lower face validity, it is sometimes important to make it appear as though there is low face validity while administering the measures. Face validity was measured by the opinion of the supervisor, my diligence and the course experts at UNISA perusing the instruments to attest whether the projected test appeared to be a good measure or otherwise. This judgement was made on the "face" of the test which made it possible for me to sufficiently judge it's validity.

3.8.5. Reliability of the Instrument

Reliability is the extent to which results are free from error or the degree to which a research instrument yields consistent results (Cooper & Schindler, 2014:43). Reliability examines whether the measuring instrument will produce the same result every time it is used. In this study, the internal consistency method was adopted because it is more stable than other

methods (Bryman, 2012:67). In this study, reliability was measured by internal consistency tests through the use of Cronbach's alpha test. Cronbach's alpha measures consistency within the instrument. Cronbach's alpha (α) is a coefficient (a number between 0 and 1) that is used to rate the internal consistency or homogeneity or the correlation of items in a test. It also assesses how well a set of item measures a given behaviour or characteristics within the test. According to Creswell (2014:55-56), for a test to be consistent internally, the estimates of reliability should be purely based on the average inter-correlations among all the single items in a test. Where α is used for reliability test, the value should be above 0.7 (Cronbach, 2004). This study accepted reliability of the instruments at 0.7. Cronbach's alpha (α) was computed as follows:

$$\alpha = \frac{k(S^2 - \sum s^2)}{S^2(k-1)}$$

Where: K = number of items in the instrument

S2 = variance of all scores

s2 = variance of individual items

Table 3.2: Reliability ranges of α

Reliability Range	Characterisation
0-6	Poor
.6-.7	Marginally Acceptable
.7-.8	Acceptable
.8-.9	Good
.9+	Very Good
.95+	Too Good

3.9. TRUSTWORTHINESS IN DATA COLLECTION AND ANALYSIS

In qualitative research, trustworthiness is critical, and a researcher has the duty of ensuring the credibility and trustworthiness of the research findings for applicability and benefit to interested parties. Lincoln and Guba (1985, cited in Shenton, 2004:64) posited that validity assumptions applicable in the naturalistic paradigm are inappropriate for evaluating qualitative research and proposed four trustworthiness criteria: credibility, transferability, dependability and conformability. These criteria and their peculiar activities are discussed next.

3.9.1. Credibility

Yin (2011:18) stated that credibility is the analysis of truth value evident in the study. Credibility focuses on the representation of the social world addressed by the study, assessing it from the viewpoint of the procedures used in the creation process for the purpose of the study. According to Yin (2011:19), credibility demonstrates that the topic has been accurately identified and described and that the research was conducted in a publicly accessible manner. Leedy and Ormrod (2005:100) further identified a prolonged stay in the field, triangulation of different methods, feedback from others and member checking as activities that increase the credibility of qualitative research. This study was credible in the application of appropriate research methods, determination of appropriate criteria for the selection of participants and triangulation of the results from the various data collection instruments.

3.9.2. Transferability

Transferability is the level to which results of a research can be transferred from one location and fit in another one appropriately. Transferability is achievable whenever the researcher provides adequate data by using rich and ample description of samples (Yin, 2011:10). The study population was teachers in primary schools in four counties. Since it is not feasible to involve the whole population, a sample of the targeted population was selected because there is similarity in teacher support structures in ICT integration in all the schools. Consequently, the research findings were transferable to other schools.

3.9.3. Dependability

Dependability refers to the need for the researcher to account for variation in conditions in the problem under study as well as the changes in the research design emanating from further understanding of the setting. The dependability criterion in this study was applied by writing a detailed report on each research participant's interview. The report also created opportunities for future research especially since teacher support structures in ICT integration in primary schools in Kenya is a developing issue that is not yet fully resolved.

3.9.4. Conformability

Conformability refer to the level to which the elements of data are confirmable by other scholars who read or critically review the research findings. Research findings were confirmed through reference to the literature review in Chapter 2 of what other scholars had stated on teacher support structures on ICT integration. Conformability was also ascertained by ensuring that the findings emanated from the views, expressions and experiences of the teachers and head-teachers on the problem in the study.

3.10.   ETHICAL ISSUES IN RESEARCH

During the research process, tension arises from the contradictions of the aims of the research and the rights of the participants. In this regard, ethics in research is paramount in that it sets out the codes of conduct guiding the entire process. Ethical issues in research are therefore the set standards for the researcher to appropriately evaluate their conduct and principles to eliminate any occurrences of harm to the participants. De Vos et al. (2011:114) identified ethical issues as the widely accepted moral governing the behaviour and conduct in the entire relationship between the researcher and the participants. In this study, relevant ethical issues included ethical clearance by the University of South Africa (Unisa), obtaining permission to do research in schools, informed consent and confidentiality of participants.

3.10.1. Ethical Clearance and Permission

Before undertaking the research, I sought Unisa's College of Education ethical clearance (Appendix 1). Written approval to interview teachers and head-teachers in Kenya was sought from the National Commission for Sciences, Technology and Innovation and from the MOE (Appendix 2, 3 and 4).

3.10.2. Informed Consent

It is the duty of the researcher to inform the participants on the nature of the study, the duration of the participants' involvement, the procedures which are followed during the research and the pros and cons to which respondents may be exposed. Participants are also made aware that they have the right to withdraw from the research at any time. In this context, the participants signed a written consent form indicating understanding and willingness to participate voluntarily in the study (Appendix 5).

3.10.3. Confidentiality

Confidentiality is the promise made by the researcher to the participants of ensuring information about the participant is kept private (Babbie, 2010:67). In this study, confidentiality was maintained through anonymous and voluntary recording of information on participants. Wherever participants felt uneasy with recording of verbal information, the recorder was switched off. Additionally, names of schools and participants were kept confidential. Codes were allocated to the interviews, namely A1–A12.

3.11.   SUMMARY OF THE CHAPTER

The methodology used in the study was articulated in this chapter. The chapter presented the research philosophy, approach and design which included the quantitative and qualitative research approach. Further, the study population, sampling techniques and data collection were elucidated. The ethical issues that are of importance in this study were highlighted. The next two chapters present the outcomes of the data collection.

CHAPTER FOUR

QUANTITATIVE DATA ANALYSIS

4.1. INTRODUCTION

The chapter makes a presentation, analysis and discussion of quantitative data gathered from respondents. The findings were based on research questions formulated in chapter 1, the theoretical and conceptual frameworks in chapter 2 and the research design discussed in chapter 3. This chapter presented the results of quantitative research, which used the teacher questionnaire. The questionnaires were the source for collecting data from teachers in the public of the selected four counties in Kenta. The focus of the responses was based on the four research questions postulated in Chapter 1 as follows:

- What are the existing teachers support structures for effective implementation of ICT in Kenya primary schools?
- How effective are these teacher support structures for implementation of ICT in Kenya Primary Schools?
- What are the expressed gaps in teacher support for ICT in the classroom environment?
- How can the teachers' interest and skills in ICT use be sustained in Kenya primary schools?

To provide the answers to these questions, three levels of statistical analysis were undertaken, namely descriptive statistics (simple percentages, mean and correlation), cluster analysis (to break down cases [teachers] into simpler numbers according to variables relating to each research question in models), and ANOVA (to test significance levels between dependent variables and moderation variables). The multivariate data analysis helped in creating a taxonomy of teachers' ICT support structures that exist in support of ICT-in-Education strategies in Kenya public primary schools. Data generated from the responses of the teachers

within the questionnaire were then interpreted and discussed as per research question of the study. Quantitative data was integrated at this stage of analysis

4.2. RESPONSE RATE

As shown in Table 4.1, the study targeted 340 participants who comprised of public primary school teachers in four Kenyan counties of Kajiado Kilifi, Nairobi and Uasin Gishu. In total, a response of 285 participants was achieved representing 80.9% of the expected response rate. As stipulated by Welman, Kruger and Mitchell (2013), a response rate of above 70% is appropriate and acceptable in research. The study attracted a high response rate by providing the respondents with two choice of responding and which included: (i) an online automated survey platform; and a paper-based putting which gave teachers adequate time to respond.

Table 4. 1 Response rate

Counties	Sample size	Return Rate	Percentage
Kilifi	50	38	76
Uasin Gishu	76	64	84.2
Kajiado	53	43	81.2
Nairobi	173	140	80.9
Total	352	285	80.9

4.3. DEMOGRAPHIC INFORMATION

Demographic information related to gender, education level, ICT training, position in the school and length of service of the respondents was sought to determine the characteristics of the respondents who participated in the study. The importance of this was to establish the general attributes of the representative sample of the target population for generalisation purposes.

4.3.1. Gender of Respondents

Feedback in Figure 4.1 indicated that majority of the respondents were male teachers accounting for 52% of the population while female teachers comprise 48% total sample

population. This is an indicator that both genders are almost equally represented in the teaching and learning process in public primary schools in Kilifi, Uasin Gishu, Kajiado and Nairobi Counties in Kenya.
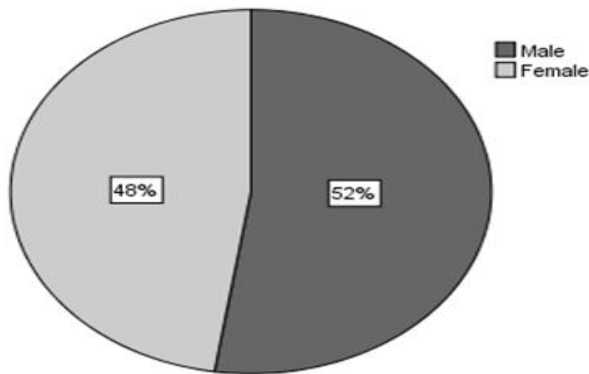
Figure 4. 1 Gender of respondents

4.3.2. Respondents' Education Level

The results in Table 4.2 indicate that overwhelming majority of teachers had a Primary 1 certificate. In addition, 9.1% had a Diploma in Education with 8.4% being Bachelor of Education holders. Additionally, 23.5% had some basic qualifications in ICT. This is indicative that the teachers teaching in public primary schools in Kilifi, Uasin Gishu, Kajiado and Nairobi Counties in Kenya had requisite professional qualifications. The minimum qualification for a teacher in public primary schools in Kenya is a Primary 1 certificate.

Table 4. 2 Education level of respondents

Certificate	Frequency	Percentage
Primary 1 certificate	232	82.1
Diploma in Education	30	10.5
Bachelor's degree in education	23	8.4
ICT Course or qualification	67	23.5
Total	285	100.0

4.3.3. Participation in ICT Related Course

Further the results presented in Table 4.2 above reflect the fact that a few teachers in public primary schools in Kilifi, Uasin Gishu, Kajiado and Nairobi Counties in Kenya have had access to ICT training either sponsored by the school or Ministry of Education. This is a clear indication that while schools may not have fully embraced ICT, official policies on teacher training in ICT exist.

4.3.4. Position Held in School

The results in Table 4.3 show that most of the teachers, 49.1% were class teachers with 43.2% acting in discipline committees. There were very few teachers designated as Computer teachers comprising only 7.7%. This is an indicator that public primary schools in Kilifi, Uasin Gishu, Kajiado and Nairobi counties in Kenya may not have the requisite capacity to promote and support teaching with ICTs.

Table 4. 3 Position held in school

Certificate	Frequency	Percentage
Class teacher	140	49.1
Designated Computer teacher	22	7.7
Discipline committee	123	43.2
Total	285	100.0

4.3.5. Length of Service in School

Results in Figure 4.2 indicate that most of the teachers, 39% had been at the school for 5-10 years with 28% having spent 1-5 years in the same school. In addition, 21% of the teachers had over 10 years in the same school. Only 11% had less than one year in the school. This information highlights the fact that majority of the teachers had adequate experience in teaching at public primary schools. Length of service by teachers was important in this study

as it would reflect their ICT-in education experience or lack of. Since the majority of the teachers had more than one year in service, it was believed that they gave reliable answers because they were deemed to be conversant with the use of Technology in the school.
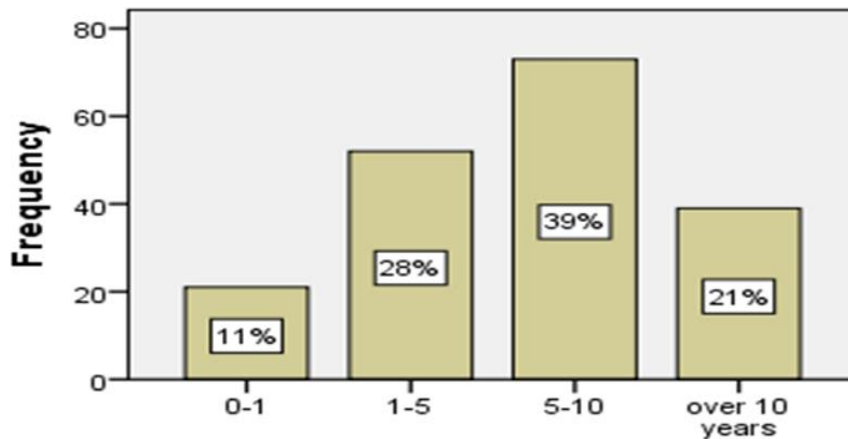
Figure 4. 2 Length of service in school

4.4. QUANTITATIVE RESULTS

Teacher support structures are critical in enhancing effectiveness in the implementation of ICT in learning institutions. This section examines the descriptive information on teacher support structures for ICT in teaching and learning process, gaps in teacher support needs for ICT in the classroom environment and mechanisms for sustaining teachers' interest and skills for effective implementation of ICT.

4.4.1. Existing Teacher Support Structures in schools

Table 4.4 responses were aimed at identifying structures that were in place to support teachers in ICT implementation in Schools. To achieve this, statements from the questionnaire together with their responses which scored on the five-point Likert scale of: Not at all; Rarely; Sometimes; Often; and Always, were presented and analysed using a frequency distribution table with percentages. For simplicity of analysis, in this study 'Sometimes', 'Often' and 'Always' were aggregated to mean 'agree' while 'rarely' and 'Not at all' were aggregated to mean 'disagree'.

Most of respondents, 55.1%, indicated that there are rare to none-existent written statements explaining general use of ICT while 44.8% attested to the existence of such statements that support implementation of ICT in the schools. Regarding the existence of detailed documents explaining use of ICT specifically for teaching and learning, only 29.1% responded affirmatively while the largest number (70%) indicated that such documents were non-existent in their schools. A majority of the respondents, 56%, indicated that their schools have adopted and unpack the MOE policy for ICT-integration in Education to support them in implementation, but a significant number stated that the MOE policy on ICT had not been adopted and unpacked in their schools. A little above half of the respondents, 51.3% stated that there were rare, or no in-school workshops convened for teachers on use of ICT, while the other 48.7% indicated that these workshops were sometimes, often and always done in their schools towards supporting teachers in use of ICT by subject clusters. Further, half of the teachers, 50.8%, disagreed that their schools motivate teachers who use ICT by reinforcing their work in various ways but almost the same number of respondents, 49.2% agreed that their school had ways of motivating teachers who were using ICT. The study findings further found that a majority of the respondent (62.6%) confirmed that there are designated teachers who champion ICT in Education to support other teachers in ICT implementation. However, 37.3% of teachers indicated that they their schools do not have ICT champions to support the rest of them with ICT implementation.

This indicated that though policies and statement supporting use of ICT were on paper but the implementation process remained a challenge. This calls for concerted efforts from stakeholders to ensure that policies speak to the implementation of ICT in schools.

Table 4. 4 Existing Teacher Support Structures for ICT Implementation

		0	1	2	3	4
		Disagree		Agree		
Variable		Not at all	Rarely	Someti mes	Often	Alwa ys
Existing Teacher Support Structures						
Our school has written statements explaining the general use of ICT to support teachers in implementation	Frequency	32	110	58	52	33
	Percentage	6.5%	48.6%	20.5%	17.3%	7.0%
	Frequency	26	50	80	91	38

Our school has explicit documents explaining use of ICT specifically for teaching and learning to support teachers in implementation	Percentage	38.4%	32.4%	16.2%	9.7%	3.2%
Our school has adopted and unpack the MOE policy for ICT-integration in Education to support teachers in implementation	Frequency	22	44	68	73	77
	Percentage	31.0%	13.0%	19.10%	18.8%	18.1%
Our schools convene regular in-school workshops for teachers on effective use of ICT by subject clusters	Frequency	35	59	65	70	56
	Percentage	24.3%	27.0%	8.1%	21.1%	19.5%
Our school motivates teachers who use ICT by reinforcing their work in various ways	Frequency	21	47	76	87	53
	Percentage	36.2%	14.6%	30.3%	1.1%	17.8%
Our school has a designated teacher or teachers who champion ICT in Education to support the ICT implementation	Frequency	68	85	60	24	48
	Percentage	2.2%	35.1%	21.6%	25.9%	15.1%
	Percentage	55.2%	30.8%	7.70%	4.20%	2.10%

4.4.2. Effectiveness of Existing Teacher Support Structures for Implementation of ICT

As presented in Table 4.5, to identify effective teacher support structures for implementation of ICT, the statements from the questionnaire together with their responses were presented and analysed using a frequency distribution table with percentages. The scores were on a five-point Likert scale of: Disagree Strongly (DS); Disagree (D); Agree Moderately (AM); Agree (A); and Agree Strongly (AS). In an effort to simplify the analysis in this study, DS and D were aggregated to mean 'disagree' while AM, A, AS were aggregated to mean 'agree'.

From the responses, it is evident that a staggering majority of teachers (91.8%) are persuaded that availability of written statements explaining general and pedagogical use of ICT guarantees their technical expertise in implementation and use of ICT in school. Only a paltry 8.2% did not agree with the need for such written statement. This demonstrates that teachers require materials that they can always refer to as need arise.

With regards to the importance of existence of MOE policy on ICT integration that has been adopted and unpacked for teachers in the school, a majority of teachers (67.9) agree that such would lead to their readiness in use of ICT. This indicated that teachers value policies that have been contextualized to their schools needs. However, a third of the respondents (30%) did not place any value in availability of the MOE policy in the school perhaps due to the fact that there could still exists a disconnect between the stated policies and the practice at school level. The majority (87%) of teachers placed a great deal of value on regularly convened in-school workshops on effective use of ICT. These teachers felt that such workshops would keep them updated in ICT teaching methodologies in the various subject areas as well as enhance their expertise in the area. A small number (13%) did not appreciate such workshop as being of value in their expertise for ICT integration.

Similarly, another majority of teachers (87.3%) felt strongly that motivating teachers who use ICT by offering them incentives reinforces the use of ICT in schools and leads to effective implementation of ICT while a minority (15.7%) did not place a lot value in this aspect. Additionally, most teachers (73.9%) indicated that existence of an ICT-in-Education department with designated teachers to champion ICT in the school will support all other teachers in effective implementation of ICT while a 26.1% of the respondents disagreed with the statement.

In general, teachers agree that they need various structures to support their effective implementation of ICT in schools. These include: written document including MOE policies that they can refer to: in-school workshops that support peer-to-peer learning; incentivisation for teacher using ICTs; and having designated ICT Champions as the go-to-teacher who would support others.

Table 4. 5 Effectiveness of the Teacher support structures for implementation of ICT

Variable		0 Disagree Strongly	1 Disagree	2 Agree Moderately	3 Agree	4 Agree Strongly
Effectiveness teacher support structures for implementation of ICT						
	Frequency	22	33	72	82	75

Availability of written statements explaining general and pedagogical use of ICT guarantees technical expertise in teachers for implementation and use of ICT.	Percentage	1.1%	7.1%	28.3%	33.7%	29.8%
Existing MOE policy on ICT integration that has been adopted and unpacked for teachers leads to readiness in use of ICT by teachers.	Frequency	32	67	59	60	66
	Percentage	6.5%	25.5%	21.2%	21.7%	25.0%
Convening regular in-school workshops for teachers on effective use of ICT, results in updated expertise on ICT teaching methodologies in the various subject areas.	Frequency	23	41	55	76	90
	Percentage	1.6%	11.4%	18.9%	30.3%	37.8%
Motivating teachers who use ICT by offering them incentives reinforces the use of ICT in schools and leads to effective implementation of ICT.	Frequency	23	95	77	44	46
	Percentage	1.6%	14.1%	13.0%	40.5%	30.8%
Establishing an ICT-in-Education department with designated teachers to champion ICT in the school will supports all other teachers with effective implementation of ICT.	Frequency	33	56	59	65	72
	Percentage	6.5%	19.6%	21.2%	24.4%	28.3%

Mean and Standard Deviation for Support Structures for ICT

The findings in Table 4.6 presented the minimal variations on the respondent's opinions concerning the teacher support structures for effective ICT implementation. Through a comparison of other measurement parameters of teacher support structures for ICT, none of the respondents' opinions attracted a significant variation.

Table 4. 6. Mean and Standard Deviation of teacher support structures and their related effectiveness

Teacher Support structures	N	Mean	Std. Deviation
Our school has written statements explaining the general use of ICT to support teachers in implementation	285	2.70	1.056
Our school has explicit documents explaining use of ICT specifically for teaching and learning to support teachers in implementation	285	2.35	1.073
Our school has adopted and unpack the MOE policy for ICT-integration in Education to support teachers in implementation	285	2.76	1.066

	285	2.38	1.122
Our schools convene regular in-school workshops for teachers on effective use of ICT by subject clusters	285	2.38	1.122
Our school motivates teachers who use ICT by reinforcing their work in various ways	285	2.36	1.044
Our school has a designated teacher or teachers who champion ICT in Education to support the ICT implementation	285	2.37	1.125
Effectiveness Teacher support structures for implementation of ICT			
Availability of written statements explaining general and pedagogical use of ICT guarantees technical expertise in teachers for implementation and use of ICT	285	2.74	0.938
Existing MOE policy on ICT integration that has been adopted and unpacked for teachers leads to readiness in use of ICT by teachers.	285	2.44	1.107
Convening regular in-school workshops for teachers on effective use of ICT, results in updated expertise on ICT teaching methodologies in the various subject areas.	285	2.36	1.328
Motivating teachers who use ICT by offering them incentives reinforces the use of ICT in schools and leads to effective implementation of ICT	285	2.84	.971
Establishing an ICT-in-Education department with designated teachers to champion ICT in the school will supports all other teachers with effective implementation of ICT	285	2.53	.862

Correlation between Teacher Support structures and their effectiveness for implementation of ICT

Correlation refers to a quantitative estimation of the oscillation of two variables with each other. The increase or decrease of two variables in parallel leads to a positive correlation. However, when one variable increase and the other decreases, then the correlation is negative. In this study, correlation analysis was undertaken to measure the strength of the linear association between the independent and dependent variables. Table 4.7 presents the correlation coefficients for aspects of teacher support structures. The results showed that the there was a positive significant correlation coefficient between effective implementation of ICT and: (i) availability of written statements explaining general and pedagogical use of ICT guarantees technical expertise in teachers for implementation and use of ICT; (ii) existence of MOE policy on ICT integration that has been adopted and unpacked for teachers leads to readiness in use of ICT by teachers; (iii) convening of regular in-school workshops for teachers on effective use of ICT, results in updated expertise on ICT teaching methodologies in the

various subject areas; (iv) motivating teachers who use ICT by offering them incentives reinforces the use of ICT in schools and leads to effective implementation of ICT; and (v) establishing an ICT-in-Education department with designated teachers to champion ICT in the school will supports all other teachers with effective implementation of ICT. This is as per the scores: (r=0.489, p<0.05). (r=0.456, p<0.05). (r=0.638, p<0.05). (r=0.458, p<0.05). (r=0.471, p<0.05). respectively

Table 4. 7 Correlation for teacher support structures and their effectiveness for implementation of ICT in Schools

Teacher Support structures for effective implementation of ICT		
Availability of written statements explaining general and pedagogical use of ICT guarantees technical expertise in teachers for implementation and use of ICT	Pearson Correlation	.489**
	Sig. (2-tailed)	.000
	N	285
Existing MOE policy on ICT integration that has been adopted and unpacked for teachers leads to readiness in use of ICT by teachers.	Pearson Correlation	.456**
	Sig. (2-tailed)	.000
	N	285
Existing policy in our school for use of ICT in specific subjects has led to psychological readiness in use of ICT by teachers.	Pearson Correlation	.638**
	Sig. (2-tailed)	.000
	N	285
Convening regular in-school workshops for teachers on effective use of ICT, results in updated expertise on ICT teaching methodologies in the various subject areas.	Pearson Correlation	.458**
	Sig. (2-tailed)	.000
	N	285
Motivating teachers who use ICT by offering them incentives reinforces the use of ICT in schools and leads to effective implementation of ICT	Pearson Correlation	.471**
	Sig. (2-tailed)	.000
	N	285
Establishing an ICT-in-Education department with designated teachers to champion ICT in the school will supports all other teachers with effective implementation of ICT	Pearson Correlation	.518**
	Sig. (2-tailed)	.000
	N	285
**. Correlation is significant at the 0.01 level (2-tailed).		

Chi-Square Test on Teacher Support structures and their Effectiveness for implementation of ICT

Chi-square test is a statistical method for making an assessment of the goodness of fit involving a set of observed values and the ones expected theoretically. Chi-square test was used to verify the strength of the association between teacher support structures and effective implementation of ICT. The results in Table 4.8 of Chi-square test showed that there was a strong association between effective implementation of ICT and presence of written statements explaining use of ICT $X2(16, N=285) = 69.931$, $p<.05$. A strong association existed between effective implementation of ICT and availability of adopted and unpacked MOE policy on ICT integration $X2(16, N=285) = 134.691$, $p<.05$. There was a strong association between regularly convening in-school workshops on subject-specific ICT methodologies and effective implementation of ICT $X2(16, N=285) = 31.760$, $p<.05$. A strong association also existed between effective implementation of ICT and incentivisation for teachers to use $X2(16, N=285) = 92.958$, $p<.05$. Finally, there was a strong association between effective implementation of ICT and establishment of a designated ICT department and champion teachers $X2(16, N=285) = 29.029$, $p<.05$.

Table 4. 8 Chi-Square for teacher support structures and their effectiveness for ICT implementation

	Tests	Values
Availability of written statements explaining general and pedagogical use of ICT guarantees technical expertise in teachers for implementation and use of ICT	Pearson Chi-Square	69.931**
	Sig. (2-tailed)	.000
	Df	16
Existing MOE policy on ICT integration that has been adopted and unpacked for teachers leads to readiness in use of ICT by teachers.	Pearson Chi-Square	134.691**
	Sig. (2-tailed)	.000
	Df	16
Convening regular in-school workshops for teachers on effective use of ICT, results in updated expertise on ICT teaching methodologies in the various subject areas.	Pearson Chi-Square	31.760*
	Sig. (2-tailed)	.011
	Df	16
Motivating teachers who use ICT by offering them incentives reinforces the use of ICT in schools and leads to effective implementation of ICT	Pearson Chi-Square	92.958**
	Sig. (2-tailed)	.000
	Df	16
Establishing an ICT-in-Education department with designated teachers to champion ICT in the school has	Pearson Chi-Square	29.029*
	Sig. (2-tailed)	.024

supported all other teachers with effective implementation of ICT.	Df		16
**P<0.01,*P<0.05			

Regression Analysis and Hypothesis Testing for Teacher Support structures' effectiveness

Regression Model Summary

In this study, correlation analysis was undertaken to measure the strength of the linear association between the independent and dependent variables. Table 4.9 presents data on R, R2 and adjusted R2 and the standard error of estimate. R represents multiple correlation coefficient, R2 represents coefficient of determination while adjusted R2 indicates the statistical value adjusted in respect to the number of independent variables in the model. This reveals the fitness of the regression model. The results in Table 4.9 shows that R=.477 which is a positive correlation, coefficient of determination R2=.228, while adjusted R2=.224 indicating the regression model fits the data. The implication is that teacher support structures contribute about 23% variance of the overall effectiveness of implementation of ICT when other factors are held constant.

Table 4. 9 Regression model summary for teacher support structures

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.477a	.228	.224	.83927192

Analysis of Variance (ANOVA)

As indicated in Table 4.10, regression ANOVA is employed as a statistical measure for understanding the level and extent of variability of the regression model. Its findings are usually a basis for testing significance. A regression ANOVA test was conducted to establish the goodness of fit of the data for the overall regression model. It also tested the level of variation of teacher support structures. The R2=.228 and F-test results in ANOVA (Table 4.10)

show that teacher support structures explained 22.8% of the variance (R^2=.228, F (1,285) =53.396, p<.05) in the regression model.

Table 4. 10 ANOVA for teacher support structures

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	37.611	1	37.611	53.396	.000b
	Residual	127.492	284	.704		
	Total	165.103	285			

a. Predictors: (Constant), Existing Teacher Support structures

b. Dependent Variable: Effectiveness of Teacher Support Structures for implementation of ICT

Regression Coefficients

Regression coefficient refers to the slope as indicated by the linear relationship between the independent and the dependent variables. For regression coefficients (Table 4.11), the study found that teacher support structures influence coefficient value of β =.454, p<.05 which is less than the critical p-value of .05 hence the null hypothesis was rejected. This implies that there is a positive and significant relationship between teacher support structures and effective implementation of ICT. This means that any improvement in teacher support structures increase effective implementation of ICT by factor of 0.454.

Table 4. 11 Regression Coefficient for teacher support structures

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	.107	.042		2.548	.012
	Teacher support structures	.454	.062	.477	7.307	.000

Dependent Variable: Effective Teacher Support Structures for implementation of ICT

4.4.3. Gaps in Teacher Support for ICT in the Classroom Environment

The results in Table 4.12 show that 60.7% stated that school do not have adequate computers in the classrooms. Another 40.7% stated that school do not ensures that computer breakdowns do not interrupt classroom teaching while 42.1% argued that investment in adequate instruction time for ICT needs has led to integration of ICT in teaching methodologies. On whether adequate computers in the classrooms have led technical expertise in teacher use of ICT, 49.5% answered in the negative.

In addition, 53.7% suggested that motivation of teachers on use ICT in classroom teaching has led to psychological readiness in use of ICT by teachers while 50.5% stated that organization of proper training of teachers on ICT use in has never led to integration of ICT in teaching. Finally, 42.8% explained that ensuring that computer breakdowns do not interrupt classroom teaching has led to psychological readiness in use of ICT by teachers. The implication is that there is need to provide requisite ICT infrastructures for the integration process to be successful.

Table 4. 12 Gaps in teacher support for ICT in the Classroom and their effectiveness in implementation of ICT in schools

		0 Not at all	1 Rarely	2 sometimes	3 Often	4 Always
Independent variable						
Gaps in teacher support for ICT in the classroom						
Our school invests in adequate instruction time for teachers support in ICT needs	Frequency	97	80	63	43	2
	Percentage	34.0%	28.1%	22.1%	15.1%	0.7%
Our school has adequate computers in the classrooms	Frequency	173	77	19	8	5
	Percentage	60.7%	27.0%	6.7%	2.8%	1.8%
Our school motivates teachers to use ICT in classroom teaching	Frequency	92	96	74	18	5
	Percentage	32.3%	33.7%	26.0%	6.3%	1.8%
Our school organizes proper training of teachers on ICT use in classrooms	Frequency	90	88	81	16	10
	Percentage	31.6%	30.9%	28.4%	15.1%	3.5%
Our school has mission and vision for use of ICT in classroom teaching	Frequency	80	98	71	30	6
	Percentage	28.1%	34.4%	24.9%	10.5%	2.1%
Our school ensures that computer breakdowns do not interrupt classroom teaching	Frequency	116	92	50	16	1
	Percentage	40.7%	32.3%	17.5%	5.6%	0.4%
Effectiveness of Teachers' Support for ICT in the classroom						

Investment in adequate instruction time for ICT needs has led to effective integration of ICT in teaching methodologies.	Frequency	120	86	52	25	2
	Percentage	42.1%	30.2%	18.3%	8.8%	0.7%
Adequate computers in the classrooms have led technical expertise in teacher use of ICT.	Frequency	141	79	45	14	6
	Percentage	49.5%	27.7%	15.8%	4.9%	2.1%
Motivation of teachers on use ICT in classroom teaching has led to psychological readiness in use of ICT by teachers.	Frequency	153	86	30	11	5
	Percentage	53.7%	30.2%	10.5%	8.8%	0.7%
Organization of proper training of teachers on ICT use in led to integration of ICT in teaching	Frequency	144	66	46	26	3
	Percentage	50.5%	30.2%	16.1%	9.1%	1.05%
Availability of mission and vision for ICT use in classroom teaching has led technical expertise in teacher use of ICT.	Frequency	108	78	78	22	1
	Percentage	37.9%	27.4%	27.4%	7.7%	0.4%
Ensuring that computer breakdowns do not interrupt classroom teaching has led to psychological readiness in use of ICT by teachers.	Frequency	122	80	56	24	3
	Percentage	42.8%	28.1%	19.6%	9.3%	1.05%

Mean and Standard Deviation for Gaps in teacher support for ICT in the Classroom

The findings in Table 4.13 presented the minimal variations on the respondent's opinions concerning the gaps in teacher support needs for ICT in the classroom environment for effective implementation of ICT. Through a comparison of other measurement parameters of gaps in teacher support needs for ICT only the statement on our school motivates teachers to use ICT in classroom teaching had a slightly higher variation (M=2.98, SD=1.040).

Table 4. 13 Mean and standard deviation for gaps in teacher support needs

	N	Mean	Std. Deviation
Gaps in teacher support for ICT in the classroom			
Our school invests in adequate instruction time for teachers support in ICT needs	285	2.62	1.170
Our school has adequate computers in the classrooms	285	2.61	.984
Our school motivates teachers to use ICT in classroom teaching	285	2.98	1.040

Our school organizes proper training of teachers on ICT use in classrooms	285	2.97	.966
Our school has mission and vision for use of ICT in classroom teaching	285	2.76	.953
Our school ensures that computer breakdowns do not interrupt classroom teaching	285	2.63	1.262
Effectiveness of Teachers' Support for ICT in the classroom			
Investment in adequate instruction time for ICT needs has led to integration of ICT in teaching methodologies	285	2.97	.903
Adequate computers in the classrooms have led technical expertise in teacher use of ICT	285	2.76	.941
Motivation of teachers on use ICT in classroom teaching has led to psychological readiness in use of ICT by teachers	285	2.63	.981
Organization of proper training of teachers on ICT use in classrooms has led to integration of ICT in teaching methodologies	285	2.97	.954
Availability of mission and vision for ICT use in classroom teaching has led technical expertise in teacher use of ICT	285	2.76	.951
Ensuring that computer breakdowns do not interrupt classroom teaching has led to psychological readiness in use of ICT by teachers	285	2.63	1.202

Correlation between Gaps in Teacher Support for ICT in the Classroom and their Effectiveness in implementation of ICT

Table 4.14 presents the correlation coefficients for aspects of teacher support for ICT teaching and learning process. The results showed that the there was a positive significant correlation coefficient between investment in adequate instruction time for ICT needs has led to integration of ICT in teaching methodologies and effective implementation of ICT ($r=0.523$, $p<0.05$). There was a positive and significant correlation between adequate computers in the classrooms have led technical expertise in teacher use of ICT and effective implementation of ICT ($r=0.581$, $p<0.05$). The correlation coefficient between motivation of teachers on use ICT in classroom teaching has led to psychological readiness in use of ICT by teachers and effection implementation of ICT ($r=0.501$, $p<0.05$).

There was a positive and significant correlation between organization of proper training of teachers on ICT use in classrooms has led to integration of ICT in teaching methodologies and effective implementation of ICT (r=0.491, p<0.05). The correlation coefficient between availability of mission and vision for ICT use in classroom teaching has led technical expertise in teacher use of ICT and effective implementation of ICT was positive and significant (r=0.507, p<0.05). Finally, there was a positive and significant correlation between ensuring that computer breakdowns do not interrupt classroom teaching has led to psychological readiness in use of ICT by teachers and effective implementation of ICT (r=0.535, p<0.05).

Table 4. 14 Correlation for teacher support for ICT in the classroom

Gaps in teacher support for ICT in the classroom		Effective Implementation of ICT
Investment in adequate instruction time for ICT skills in the classroom has led to integration of ICT in teaching methodologies	Pearson Correlation	.523**
	Sig. (2-tailed)	.000
	N	285
Adequate computers in the classrooms have led technical expertise in teacher use of ICT	Pearson Correlation	.581**
	Sig. (2-tailed)	.000
	N	285
Motivation of teachers on use ICT in classroom teaching has led to psychological readiness in use of ICT by teachers	Pearson Correlation	.501**
	Sig. (2-tailed)	.000
	N	285
Organization of proper training of teachers on ICT use in classrooms has led to integration of ICT in teaching methodologies	Pearson Correlation	.491**
	Sig. (2-tailed)	.000
	N	285
Availability of mission and vision for ICT use in classroom teaching has led technical expertise in teacher use of ICT	Pearson Correlation	.503**
	Sig. (2-tailed)	.000
	N	285
Ensuring that computer breakdowns do not interrupt classroom teaching has led to psychological readiness in use of ICT by teachers	Pearson Correlation	.507**
	Sig. (2-tailed)	.000
	N	285
**. Correlation is significant at the 0.01 level (2-tailed).		

Chi-Square Test on Gaps in Teacher Support for ICT in the classroom and their effectiveness Implementation of ICT

Chi-square test is a statistical method for making an assessment of the goodness of fit involving a set of observed values and the ones expected theoretically. Chi-square test was used to verify the strength of the association between teacher support structures and effective implementation of ICT. The results in Table 4.15 of Chi-square test showed that there was a strong association between investment in adequate instruction time for ICT needs has led to integration of ICT in teaching methodologies and effective implementation of ICT $X2(16, N=285) =74.230, p<.05$. A strong association existed between adequate computers in the classrooms have led technical expertise in teacher use of ICT and effective implementation of ICT $X2(16, N=285) = 49.117, p<.05$.

There was a strong association between motivation of teachers on use ICT in classroom teaching has led to psychological readiness in use of ICT by teachers and effective implementation of ICT $X2(16, N=285) = 60.012, p<.05$. A strong association existed between organization of proper training of teachers on ICT use in classrooms has led to integration of ICT in teaching methodologies and effective implementation of ICT $X2(16, N=285) = 46.340, p<.05$. A strong association existed between availability of mission and vision for ICT use in classroom teaching has led technical expertise in teacher use of ICT and effective implementation of ICT $X2(16, N=285) = 61.122, p<.05$. Finally, there was a strong association between ensuring that computer breakdowns do not interrupt classroom teaching has led to psychological readiness in use of ICT by teachers and effective implementation of ICT $X2(16, N=285) = 36.002, p<.05$.

Table 4. 15 Chi-Square test for gaps in teacher support for ICT in the classroom

Gaps in teacher support for ICT in the classroom	Tests	Values
Investment in adequate instruction time for ICT needs has led to integration of ICT in teaching methodologies	Pearson Chi-Square	74.230**
	Sig. (2-tailed)	.000
	Df	16
Adequate computers in the classrooms have led technical expertise in teacher use of ICT	Pearson Chi-Square	49.117**
	Sig. (2-tailed)	.000
	Df	16
	Pearson Chi-Square	60.012**

Motivation of teachers on use ICT in classroom teaching has led to psychological readiness in use of ICT by teachers	Sig. (2-tailed)	.000
	Df	16
Organization of proper training of teachers on ICT use in classrooms has led to integration of ICT in teaching methodologies	Pearson Chi-Square	46.340**
	Sig. (2-tailed)	.003
	Df	16
Availability of mission and vision for ICT use in classroom teaching has led technical expertise in teacher use of ICT	Pearson Chi-Square	61.122**
	Sig. (2-tailed)	.000
	Df	16
Ensuring that computer breakdowns do not interrupt classroom teaching has led to psychological readiness in use of ICT by teachers	Pearson Chi-Square	36.002**
	Sig. (2-tailed)	.006
	Df	16
**P<0.01,*P<0.05		

Regression Analysis and Hypothesis Testing for Gaps in Teacher Support for ICT in the classroom

Regression Model Summary

Table 4.16 presents data on R, R2 and adjusted R2 and the standard error of estimate. R represents multiple correlation coefficient, R2 represents coefficient of determination while adjusted R2 indicates the statistical value adjusted in respect to the number of independent variables in the model. This reveals the fitness of the regression model. The results shows that R=.707 which is a positive correlation, coefficient of determination R2=.500, while adjusted R2=.497 indicating the regression model fits the data. The implication is that reducing the gaps in teacher support needs for ICT contributes about 50% variance of the overall effectiveness of implementation of ICT when other factors are held constant.

Table 4. 16 Regression Model Summary for gaps in teacher support for ICT in the classroom

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.707a	.500	.497	.67604998

ANOVA

As indicated in Table 4.17, regression ANOVA was employed as a statistical measure for understanding the level and extent of variability of the regression model. Its findings are usually a basis for testing significance. A regression ANOVA test was conducted to test the goodness of fit of the data for the overall regression model. It also tested the level of variation of gaps in teacher support needs for ICT. The R2=.500 and F-test results in ANOVA show that gaps in teacher support needs for ICT explained 50% of the variance (R2=.500, F (1,285) =181.811, p<.05) in the regression model.

Table 4.17 ANOVA for gaps in teacher ICT needs

Model		Sum of Squares	Df	Mean Square	F	Sig.
	Regression	83.095	1	83.095	181.811	.000b
1	Residual	83.182	284	.457		
	Total	166.277	285			

a. Predictors: (Constant), Gaps in teacher support for ICT in the classroom

b. Dependent Variable: Effectiveness of teacher support for ICT in the classroom

Regression Coefficients

Regression coefficient refers to the slope as indicated by the linear relationship between the independent and the dependent variables. For regression coefficients (Table 4.18), the study found that gaps in teacher support needs for ICT influence coefficient value of β =.673, p<.05 which is less than the critical p-value of .05 hence the null hypothesis was rejected. This implies that there is a positive and significant relationship between gaps in teacher support needs for ICT and effective implementation of ICT. This means that any improvement in gaps in teacher support needs for ICT increase effective implementation of ICT by factor of 67.3%.

Table 4.18 Coefficients for gaps in teacher support for ICT in the classroom

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.100	.050		2.000	.047
	Gaps in teacher support for ICT in the classroom	.673	.050	.707	13.484	.000

a. Dependent Variable: Effectiveness of the teacher support for ICT in the classroom

4.4.4. Strategies towards sustaining teachers' interest and skills in ICT use for effective implementation of ICT in Kenya Primary Schools

The results in Table 4.19 show that 53.3% stated that never do schools have adequate and well-trained teachers on ICT use. In addition, 55.1% stated that sometimes the school has reliable sources of power to support ICT use in classroom teaching while 43.2% argued that teachers often have satisfaction with the introduction of ICTs in curriculum. On whether adequacy of well-trained teachers on ICT use has led to integration of ICT in teaching methodologies, 43.2% stated this is often the case. In addition, 45.6% suggested that sufficient number of computers to support ICT integration has sometimes led to integration of ICT in teaching methodologies. Finally, 42.8% stated that teachers' satisfaction with the introduction of ICTs in curriculum has often led technical expertise in teacher use of ICT.

Table 4.19 Strategies for sustaining ICT interest in teachers

		0	1	2	3	4
Independent variable		Not at all	Rarely	Sometimes	Often	Always
Strategies for sustaining teachers' interest and skills in ICT						
Our school has adequate and well-trained teachers on ICT use	Frequency	152	79	42	9	3
	Percentage	53.3%	27.7%	14.7%	3.2%	1.1%
	Frequency	4	39	157	77	8

Our school has reliable sources of power to support ICT use in classroom teaching	Percentage	1.4%	13.7%	55.1%	27%	2.8%
Our teachers have positive attitudes towards ICT use in classroom teaching	Frequency	0	45	61	108	61
	Percentage	0.0%	15.8%	21.4%	37.9%	10.5%
Our school has sufficient number of computers for ICT integration	Frequency	35	69	72	79	30
	Percentage	12.3%	24.2%	25.3%	27.7%	10.5%
Our teachers welcome the introduction of ICTs in curriculum	Frequency	22	33	72	123	35
	Percentage	7.7%	11.6%	25.3%	43.2%	12.3%
Our teachers' have confidence in ICT integration in classroom teaching	Frequency	23	34	92	94	42
	Percentage	8.1%	11.9%	32.3%	33%	14.7%
Effectiveness of the strategies for sustaining teachers' interest and skills in ICT for effective implementation of ICT						
Adequacy of well-trained teachers on ICT use has led to integration of ICT in teaching methodologies.	Frequency	41	39	35	123	47
	Percentage	14.4%	13.7%	12.3%	43.2%	16.5%
Reliability of sources of power to support ICT use in classroom teaching has led technical expertise in teacher use of ICT	Frequency	23	46	50	81	85
	Percentage	8.1%	16.1%	17.5%	28.4%	16.5%
Teachers' positive attitudes towards ICT use in classroom teaching have led to psychological readiness in use of ICT by teachers	Frequency	44	66	31	76	68
	Percentage	15.4%	23.2%	10.9%	26.7%	23.9%
Sufficient number of computers to support ICT integration has led to integration of ICT in teaching methodologies.	Frequency	43	68	130	22	22
	Percentage	15.1%	23.9%	45.6%	7.7%	7.7%
Teachers' acceptance with the introduction of ICTs in curriculum has led technical expertise in teacher use of ICT.	Frequency	21	39	66	122	37
	Percentage	7.4%	13.7%	23.2%	42.8%	13.0%
Teachers' confidence in ICT integration in classroom teaching has led to psychological readiness in use of ICT by teachers.	Frequency	52	45	56	108	34
	Percentage	18.2%	15.8%	19.6%	37.9%	11.9%

Mean and Standard Deviation for Strategies Towards Sustaining Teachers' Interest and Skills in ICT for effective implementation of ICT in schools

The findings in Table 4.20 presented the minimal variations on the respondent's opinions concerning the mechanisms for sustaining teachers' interest and skills in ICT for effective implementation of ICT. Through a comparison of other measurement parameters of mechanisms for sustaining teachers' interest and skills in ICT only the statement on sufficient number of computers to support ICT integration has led to integration of ICT in teaching methodologies had a slightly higher variation (M=2.93, SD=.945).

Table 4.20 Mean and standard deviation for sustaining teacher ICT interest and skills for effective implementation of ICT in schools

Strategies for sustaining teachers' interest and skills in ICT	N	Mean	Std. Deviation
Our school has adequate and well trained teachers on ICT use	285	2.38	1.121
Our school has reliable sources of power to support ICT use in classroom teaching	285	2.36	1.023
Our teachers have positive attitudes towards ICT use in classroom teaching	285	2.84	.943
Our school has sufficient number of computers to support ICT integration	285	2.87	.962
Our teachers have satisfaction with the introduction of ICTs in curriculum	285	2.34	.953
Our teachers' have confidence in ICT integration in classroom teaching	285	2.45	.932
Effectiveness of the Strategies for sustaining teachers' interest and skills in ICT for effective implementation of ICT			
Adequacy of well trained teachers on ICT use has led to integration of ICT in teaching methodologies.	285	2.91	.903
Reliability of sources of power to support ICT use in classroom teaching has led technical expertise in teacher use of ICT	285	2.88	.933

Teachers' positive attitudes towards ICT use in classroom teaching have led to psychological readiness in use of ICT by teachers	285	2.64	.946
Sufficient number of computers to support ICT integration has led to integration of ICT in teaching methodologies	285	2.93	.945
Teachers' acceptance with the introduction of ICTs in curriculum has led technical expertise in teacher use of ICT.	285	2.76	.955
Teachers' confidence in ICT integration in classroom teaching has led to psychological readiness in use of ICT by teachers.	285	2.62	1.211

Correlation between Strategies for Sustaining Teachers' Interest and Skills in ICT and their Effectiveness

Table 4.21 presents the correlation coefficients for aspects of teacher support for ICT teaching and learning process. The results showed that the there was a positive significant correlation coefficient between adequacy of well-trained teachers on ICT use and effective implementation of ICT ($r=0.532$, $p<0.05$). There was a positive and significant correlation between reliability of sources of power to support ICT use in classroom teaching and effective implementation of ICT ($r=0.491$, $p<0.05$). The correlation coefficient between teachers' positive attitudes towards ICT use in classroom teaching and effective implementation of ICT ($r=0.504$, $p<0.05$).

There was a positive and significant correlation between sufficient number of computers to support ICT integration and effective implementation of ICT ($r=0.522$, $p<0.05$). The correlation coefficient between teachers' satisfaction with the introduction of ICTs in curriculum and effective implementation of ICT was positive and significant ($r=0.511$, $p<0.05$). Finally, there was a positive and significant correlation between teachers' confidence in ICT integration in classroom teaching and effective implementation of ICT ($r=0.512$, $p<0.05$).

Table 4.21 Correlation for strategies of sustaining teacher ICT interest and skills

Strategies for sustaining teachers' interest and skills in ICT		Effective implementation of ICT
Adequacy of well trained teachers on ICT use has led to integration of ICT in teaching methodologies.	Pearson Correlation	.532**
	Sig. (2-tailed)	.000
	N	285
Reliability of sources of power to support ICT use in classroom teaching has led technical expertise in teacher use of ICT	Pearson Correlation	.491**
	Sig. (2-tailed)	.000
	N	285
Teachers' positive attitudes towards ICT use in classroom teaching have led to psychological readiness in use of ICT by teachers	Pearson Correlation	.504**
	Sig. (2-tailed)	.000
	N	285
Sufficient number of computers to support ICT integration has led to integration of ICT in teaching methodologies.	Pearson Correlation	.522**
	Sig. (2-tailed)	.000
	N	285
Teachers' acceptance with the introduction of ICTs in curriculum has led technical expertise in teacher use of ICT.	Pearson Correlation	.511**
	Sig. (2-tailed)	000
	N	285
Teachers' confidence in ICT integration in classroom teaching has led to psychological readiness in use of ICT by teachers.	Pearson Correlation	.512**
	Sig. (2-tailed)	000
	N	285
**. Correlation is significant at the 0.01 level (2-tailed).		

Chi-Square Test on Strategies for Sustaining Teachers' Interest and Skills in ICT for Effective Implementation of ICT

Chi-square test is a statistical method for assessing the goodness of fit involving a set of observed values and the ones expected theoretically. Chi-square test was used to verify the strength of the association between teacher support structures and effective implementation of ICT. The results in Table 4.22 of Chi-square test showed that there was a strong association between adequacy of well-trained teachers on ICT use and effective implementation of ICT $X2(16, N=285) = 64.020$, $p<.05$. A strong association existed between reliability of sources of power to support ICT use and effective implementation of ICT $X2(16, N=285) = 53.111$, $p<.05$.

There was a strong association between teachers' positive attitudes towards ICT use in classroom teaching and effective implementation of ICT X2(16, N=285) = 59.673, p<.05. A strong association existed between sufficient number of computers to support ICT integration and effective implementation of ICT X2(16, N=285) = 48.321, p<.05.

A strong association existed between teachers' satisfaction with the introduction of ICTs in curriculum and effective implementation of ICT X2(16, N=285) = 59.432, p<.05. Finally, there was a strong association between teachers' confidence in ICT integration in classroom teaching and effective implementation of ICT X2(16, N=285) = 41.983, p<.05.

Table 4.22 Chi-Square for strategies for sustaining teacher ICT interest and skills

Mechanisms for sustaining teachers' interest and skills in ICT	Tests	Values
Adequacy of well-trained teachers on ICT use has led to integration of ICT in teaching methodologies.	Pearson Chi-Square	64.020**
	Sig. (2-tailed)	.000
	Df	16
Reliability of sources of power to support ICT use in classroom teaching has led technical expertise in teacher use of ICT	Pearson Chi-Square	53.111**
	Sig. (2-tailed)	.000
	Df	16
Teachers' positive attitudes towards ICT use in classroom teaching have led to psychological readiness in use of ICT by teachers	Pearson Chi-Square	59.673**
	Sig. (2-tailed)	.000
	Df	16
Sufficient number of computers to support ICT integration has led to integration of ICT in teaching methodologies.	Pearson Chi-Square	48.321**
	Sig. (2-tailed)	.003
	Df	16
Teachers' acceptance with the introduction of ICTs in curriculum has led technical expertise in teacher use of ICT.	Pearson Chi-Square	59.432**
	Sig. (2-tailed)	.000
	Df	16
Teachers' confidence in ICT integration in classroom teaching has led to psychological readiness in use of ICT by teachers.	Pearson Chi-Square	41.983**
	Sig. (2-tailed)	.000
	Df	16
**P<0.01,*P<0.05		

Regression Analysis and Hypothesis Testing for Strategies for Sustaining Teachers' Interest and Skills in ICT

Regression Model Summary

Table 4.23 presents data on R, R2 and adjusted R2 and the standard error of estimate. R represents multiple correlation coefficient, R2 represents coefficient of determination while adjusted R2 indicates the statistical value adjusted in respect to the number of independent variables in the model. This reveals the fitness of the regression model. The results in Table 4.29 shows that R=.731 which is a positive correlation, coefficient of determination R2=.535, while adjusted R2=.532 indicating the regression model fits the data. The implication is that mechanisms for sustaining teachers' interest and skills in ICT contributes about 53.5% variance of the overall effectiveness of implementation of ICT when other factors are held constant.

Table 4.23 Model summary for mechanisms for sustaining teacher ICT interest

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.731a	.535	.532	.62090105

ANOVA

As indicated in Table 4.24, regression ANOVA is employed as a statistical measure for understanding the level and extent of variability of the regression model. Its findings are usually a basis for testing significance. A regression ANOVA test was conducted to test the goodness of fit of the data for the overall regression model. It also tested the level of variation of mechanisms for sustaining teachers' interest and skills in ICT. The R2=.535 and F-test results in ANOVA show that mechanisms for sustaining teachers' interest and skills in ICT explained 50% of the variance (R2=.535, F (1,285) =210.217, p<.05) in the regression model.

Table 4.24 ANOVA for mechanisms for sustaining teachers' ICT interest

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	81.042	1	81.042	210.217	.000b
	Residual	70.550	283	.386		
	Total	151.592	284			

a. Predictors: (Constant), Strategies for sustaining teachers' interest & skills in ICT

b. Dependent Variable: Effectiveness of the Strategies for Implementation of ICT in schools

Regression Coefficients

Regression coefficient refers to the slope as indicated by the linear relationship between the independent and the dependent variables. For regression coefficients (Table 4.25), the study found that mechanisms for sustaining teachers' interest and skills in ICT influence coefficient value of β =.664, p<.05 which is less than the critical p-value of .05 hence the null hypothesis was rejected. This implies that there is a positive and significant relationship between mechanisms for sustaining teachers' interest and skills in ICT and effective implementation of ICT. This means that any improvement in mechanisms for sustaining teachers' interest and skills in ICT increase effective implementation of ICT by factor of 66.4%.

Table 4.25 Coefficients for mechanisms for sustaining teachers ICT interest

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.099	.046		2.167	.032
	Mechanisms for sustaining teachers' interest and skills in ICT	.664	.046	.731	14.499	.000

4.5. SUMMARY OF THE CHAPTER

This chapter presented the results of the analysed data of the four research questions postulated in Chapter 1 and which set out to identify existing support structures for use of ICTs by teachers in the Kenya primary schools, how effective are these support structures were, what gaps exist and what activities would enhance and sustain use of ICTs in schools. The results of this quantitative analysis were based on the techniques applied in the study which included percentages, linear regression using descriptive and inferential statistics analysis. The next chapter presents the qualitative results of the analysed qualitative data.

CHAPTER FIVE

QUALITATIVE FINDINGS OF THE STUDY

5.1. INTRODUCTION

The chapter provides analysis, presentation and discussion of qualitative data gathered from participants through interviews. The findings were based on research questions formulated in Chapter 1. These are:

- What are the existing teachers support structures for effective implementation of ICT in Kenya primary schools?
- How effective are these teacher support structures for implementation of ICT in Kenya Primary Schools?
- What are the expressed gaps in teacher support for ICT in the classroom environment?
- How can the teachers' interest and skills in ICT use be sustained in Kenya primary schools?

5.2. PARTICIPANTS' DEMOGRAPHIC, CHARACTERISTICS & ANONIMISATION OF THEIR DATA

As shown in Table 5.1, in terms of education level 8.3% had Primary 1 certificate, 16.7% had Diploma in Education, 41.7% were holders of Bachelor in Education degree while 33.3% had Masters in Education degree. In terms of length of service in current school, 8.3% had stayed for 0-1 years, 58.3 % had 1-5 years, 25% had stayed for 5-10 years while 8.3% had over 10 years of service. Additionally, 23.5% had some basic qualifications in ICT. Consequently, from the results of the distribution above, the views of the participants count provide relevant information on the understanding of teacher support structures for effective implementation of ICT in Kenya primary schools.

Table 5.2 presents number of participants and study names used for this research. The head teachers involved in generating this qualitative data were referred to as: HTA, HTB, HTC, HTD, HTE, HTF, HTG, HTH, HTI, HTJ, HTK and HTL. This coding was derived from assigning the twelve school an alphabet from A to L, each representing a different school. The head teachers were coded as HT. This was done to anonymise them as agreed ahead of the interviews.

Table 5. 1 Education level and length of service

Education level and length of service of interview participants				
Education level and length of service	Interview participants			
	Male	Female	Total	Percentages
Primary 1 Certificate	-	1	1	8.3
Diploma in Education	1	1	2	16.7
Bachelor of Education	1	4	5	41.7
Others- Masters in Education	1	3	4	33.3
0-1 years	1	-	1	8.3
1-5 years	4	3	7	58.3
5-10 years	2	1	3	25
Over 10 years	-	1	1	8.3
ICT qualification	37	30	67	23.5
Total			12	100.0

Table 5.2: Participants' coding for anonymity

Head teacher	Head teacher
HTA	HTH
HTB	HTI
HTC	HTJ
HTD	HTK
HTE	HTL
HTF	
HTG	

5.3. DEVELOPMENT OF THEMES AND CATEGORIES

The focus of this section is on the themes of the study which were developed from the responses of the participants. An analysis was done theme by theme in accordance with the research questions and direct quotations were presented and deductions were drawn from systems theory that guided study together with literature reviewed.

The themes were based on the head teachers basic support role in ICT integration in school context. The main themes related to the following four areas as per the research questions for this study:

- The existing support structures for teachers in ICT integration
- The effectiveness of the support structures in ICT integration
- The gaps in teacher support for ICT in the classroom
- Sustainability of teachers' interest and skills in ICT integration

Table 5.3 illustrates the themes and sub-themes classifications that emerged from the interviews.

Table 5.3 Themes and sub-themes that emerged from the interviews

S/No.	Research question	Interview question	Themes and sub-themes
	What are the existing teachers support structures for effective implementation of ICT in Kenya primary schools?	How would you describe the current teachers support structures for ICT integration in your school? How do you support ICT integration in your school? How do you monitor and evaluate ICT integration in your school?	Theme 1: Participants' description of current teachers support structures for ICT integration Sub-themes: Head Teachers' role and support to teachers for ICT integration Monitoring and Evaluation of ICT integration
	How effective are these support structures in teaching and learning with ICT?	What is the role of the head teachers in success of ICT integration in your school? How do you support the effectiveness of the teachers	Theme 2: Participants description of the effectiveness of their support for ICT integration Sub-themes:

		in driving ICT integration in your school? How do you identify areas of development of teachers for success of ICT integration in your school?	Head teachers' role in supporting training need for teachers in ICT integration Head teachers' role in supporting teachers with ICT infrastructure
	What are the expressed gaps in teacher support for ICT in the classroom environment?	Which teacher training gaps have you identified for ICT integration and what have you done it? Which ICT infrastructure gaps have you identified and what have you done about it?	Theme 3: participants description of teachers support gaps for ICT integration Sub-themes: Teacher capacity gaps and solutions ICT Infrastructure gaps and solutions
	How can the teachers' interest and skills in ICT use be sustained in Kenya primary schools?	How do you motivate your teachers to sustain interest in ICT integration?	Theme 4: Participants description of motivation practices for sustenance of interest of ICT integration among teachers

5.4. THE FINDINGS

The findings were outlined as per the themes derived from the research questions as follows:

5.4.1. Theme 1: Participants' description of current support structures for ICT integration

Research question: What are the existing teachers support structures for effective implementation of ICT in Kenya primary schools?

The main focus of this interview theme was to secure additional contextual information from the schools' head teachers regarding their current teachers support structures for ICT implementation. This included role in supporting their teachers with ICT integration and examined their monitoring, supervision and evaluation practices undertaken towards improving the support to teachers for ICT integration. The next section explores the sub-themes

in order to deep-dive into head teachers' information regarding support to teachers with effective implementation of ICT in schools.

5.4.1.1.   Sub-theme 1: Head teachers' role and support to teachers for ICT integration

Head teachers hold a pivotal role in the success of ICT integration in primary schools. This is because their leadership role in the school and the fact that they are the interface between government policies and in-school manifestation of the same. They support both teachers and learners with ICT integration in the classroom activities.

In responding to the question on what teachers support structures exist in Kenya primary schools, the 12 head teachers from the 12 primary schools had varied feedback. The response indicated most schools have not established or adopted structures to support teachers with ICT implementation. This was evident in the responses from HTC, HTD, HTE, HTG , HTH, HTI, HTK and HTL who indicated that they are not aware of any structures that needed to be put in place in their schools. HTG in particular had the following response:

"As the head teacher I understand the importance and integral role of integration of ICT in the teaching/learning process in our current times. However, I have not formalised the procedures and process that the teachers need to go through. This is because this has not been communicated well by the MOE and TSC. I cannot think of anything I would do apart from verbal encouragement of teachers to use ICT"

Based on the views raised by most participants it may be concluded that a substantial number of the primary schools have not formalised the integration of ICT and therefore do not have any mechanism that they could refer to as a structure for ICT support.

However, four of the respondents indicated to support teachers with ICT capacity by fully engaging the school in external initiatives that support teachers skills and confidence in ICT integration. HTA indicated as follows:

"My school has been lucky to be involved in 2 external initiatives that have supported me and the teachers with ICT integration. Through these projects, I have ensured that teachers have

free time to join the perioding training, I have designated ICT champions and I committed to ensuring the ICT infrastructure provided is operational as well as availability of electricity"

The success of integration of ICT in the teaching and learning process requires tremendous support from stakeholders for it to be effective and successful to the learners. This support may be in the form of equipment, infrastructures, development of application and training of teachers. At the school level, the head teacher is expected to steer the process to its eventual success. It is with this knowledge in mind that this question was posed in an interview to 12 primary schools involving seven female and five male head teachers. The responses showed that head teachers usually support the ICT integration process in various ways to complement the support from the government and other stakeholders. This is notable in the following response by HTF:

"It is the duty of the head teacher to solicit for ICT-related assistance from the government and other stakeholders. With this understanding, I normally push and make the necessary follow-up with stakeholders for the schools to be connected in the power grid since electricity is important in powering ICT equipment. As the head teacher I usually analyse the ICT related training needs for the teachers. I inform the teachers on availability of training sessions such as workshops and seminars. I also appoint the teachers to attend such trainings"

In conclusion, the head teachers in the few schools that have substantive ICT integration indicated that they usually go out of their way to ensure that the requisite environment for ICT integration which includes maintaining the devices and services like electricity are available in the school. They also identify opportunities for their teachers to gain extra skills in ICT integration. This affirms the critical role of the head teacher as a critical enabler for ICT integration in the schools.

5.4.1.2. Sub-theme 2: Monitoring and Evaluation (M&E) of ICT integration

This sub-theme and its related interview questions set out to establish the head teachers' role in the all-critical aspect of monitoring and evaluating ICT integration activities by teachers. All but one head teachers indicated that they have not taken up the role of M&E of the ICT initiatives. Eleven of the twelve were not sensitive to this need and indicated that this function

seats at the Ministry's officers. THJ's response was perhaps the most evident of this as it asserted

"You know with M&E, the head teacher is not tasked with this because it rests with the Ministry's Curriculum Support Officers. It has not been highlighted as a task that we need to engaged in. However, with this discussion, it would be a good idea to have a structure to monitor, evaluate and make improvement at school level. This would require that we get trained"

One respondent, HTA, indicated that an external project on ICT integration has an inbuilt M&E structure that s/he has taken leadership of. The statement was:

"Within the project, there is a structures M&E component that allows me to keep check of all the aspects of the project including: devices performance, teachers' need for more support and learning outcome improvement. This requires me to keep data of these aspects that are then discussed quarterly"

5.4.2. Theme 2: Participants' description of the effectiveness of the support structures in ICT integration

Research question: How effective are these support structures in teaching and learning with ICT?

5.4.2.1. Sub-theme 1: Head teachers' role in supporting training need for teachers in ICT integration

The success of ICT integration process depends on the ability of stakeholders in enhancing the skills and knowledge levels of the teachers. At school level, the head teacher is instrumental in ensuring that teachers have access to that, and professional development aligned to ICT integration in their teaching activities. This is due to the fact that teachers are the fulcrum for the effectiveness and success of ICT integration at the school level. Teachers with the requisite knowledge base and skills for ICT integration have the ideal foundation for inculcating ICT integration in the teaching learning process.

The interview question sought to understand the strategies used by head teachers in identifying training needs and supporting acquisition of the same. The responses from the interview with 12 primary schools head teachers revealed that in schools where ICT integration has been adopted, training of teachers is a continuous exercise and that the head teacher has to be the overall champion of it. The head teacher HTA stated the following:

"The policy of the Ministry of Education is to have ICT champions in the school and Curriculum Support Officers, whose work is to train all the teachers in ICT integration in the curriculum. My work is to be the 'champion of the teacher champions' in order to lead by example. There are a number of trainings that are conducted at the sub-county, either by the ministry, development partners or private sector. My work is to keep my ears on the ground to know when the sessions are happening and to free the teachers with most need for ICT support to attend these trainings"

5.4.2.2.   Sub-theme 2: Head Teachers' role in supporting teachers with ICT infrastructure

Alongside training needs for ICT, the head teacher would ideally support all aspects of ICT-integration which includes the requisite ICT environment. To ascertain that this was well understood and undertaken by headteachers, the related information was sought which yielded the following response from HTI, that:

"As the school head teacher it is my responsibility to ensure that the school has sufficient number of computers to support ICT teaching and learning process, electricity is paid and that if need be, a technician is on call to repair devices. I also have to ensure that teachers are computer literate and with necessary basic skills to troubleshoot if the devices have minor issues"

It is evident that the head teachers understand that it is their duty to steer ICT integration in the schools. This is through making efforts towards both enhancing teachers skills and also ensuring that there is minimum infrastructure for effective ICT implementation in schools. In conclusion, it can be said that it is of paramount importance that head teacher provides practical support to the teachers to ensure that ICT integration in the school is embraced. This support

has to be provided in order to enhance the skills and general ability of the teachers to have the capacity and interest for ICT integration. The support given may range from material to moral support to ensure that the teachers are well equipped and confident to go extra miles in integrating ICT in the classroom.

5.4.3. Theme 3: Description of teachers support gaps for ICT integration in the classroom

Research Question: What are the expressed gaps in teacher support for ICT in the classroom environment?

5.4.3.1. Sub-theme 1: Teacher capacity gaps and solutions

The importance of teachers, as the most pivotal stakeholder in ICT integration process, to be equipped with the necessary skills, cannot be over-emphasised.

The question posed to the headteachers to respond to this theme was: what teacher training gaps have you identified for ICT integration and what have you done it?. On particular response from HTB encapsulated the wider challenge for ICT integration, it read:

"To start with, due to scarcity of financial resources, schools have insufficient capacity to support all the teachers to gain the necessary technical capability to effectively participate in ICT integration. In addition, many schools lack the technical support for teachers for support of ICT teaching and learning process. Teachers also lack the psychological preparedness for ICT integration due to insufficient technical support from schools"

Evidently, the head teachers are acutely aware of the gaps that exist for effective implementation of ICT in schools which are highlighted above as: teachers ICT skills, ICT Devices and Teachers Psychological Preparedness for the shift from traditional to digital teaching. It appears that the head teachers have little leverage on instituting mitigation strategies for the above as most of them have a financial implication.

That said, HTG stated:

"I know that my teachers require constant and updated skills in ICT especially related to each subject. I am particularly interested in science and mathematics teachers championing the use of technology in subjects teaching. As for solution, we rely heavily on the MOE's directives and so we have little flexibility. However, I encourage my teachers to interact with other teachers from other schools who have ICT skills and I also encourage them to attend seminars done at sub-county level for ICT in education"

This statement from HTG indicates that some head teachers are aware of the capacity gaps with their teachers and are proactive in directing them to potential solutions. However, HTG also highlights that they do not have enough power to support their teachers as they would wish.

Another response by HTB was:

"since I interact with my teachers, I know those who have interest in ICT and I usually support them. The Ministry of Education also calls for teachers to get involved in understanding the importance of ICT integration in the curriculum. I have supported the training of ICT champions in the schools and these are the ones who assist me in identification of the training needs for the teachers"

HTB's amplifies the critical role of ICT teacher champions in school. It is evident that head teachers normally support teachers with interest in ICT. They also encourage all the teachers in their schools to acquire the necessary ICT skills for successful ICT integration offered by the Ministry.

It is important for the teachers and other curriculum implementers to have the necessary skills to enhance the quality of the teaching and learning process. Identification of the training needs of the teachers is an important milestone in ensuring that the necessary support can be sought requisite skills to be acquired. The head teachers have the duty of creating appropriate understanding of the training needs of the teachers for transmission of this information to the necessary stakeholders for the necessary training implemented.

Sub-theme 2: ICT Infrastructure gaps and solutions

In response to the question presented as: which ICT infrastructure gaps have you identified and what have you done about it?, the response from all the 12 respondent was unanimous that teachers devices, reliable internet connectivity and constant electricity are a major barrier to the effective implementation of ICT in the schools.

However, one respondent, HTC, had a more positive response as follows:

"Due to an external projects' implementation, my school has satisfactory internet connectivity, but I still struggle with devices for teachers and constant electricity"

HTH also stated:

"My school has made investment in purchasing the staffroom with one desktop computer that is useful for teachers to interact with and enhance their ICT skills. This has created the enthusiasm for teachers to improve and create integration of ICT in teaching methodologies".

It can be concluded that ICT infrastructure remains a major barrier to effective ICT integration for teachers. However, it is commendable that some external projects have supported schools while in-school initiatives have seen schools invest in basic ICT equipment such as desktop computers.

5.4.4. Theme 4: participants description of motivation practices for sustenance of interest of ICT integration among teachers

Research question: How can the teachers' interest and skills in ICT use be sustained in Kenya primary schools?

For effective implementation of the ICT integration process in the schools, the teachers should have the necessary framework of mind to participate in the process. Teacher motivation is an important element in sustenance of the interest of the teacher in ICT implementation in schools. The head teacher is instrumental in motivating teachers to sustain their interest and skills for ICT integration. The next section makes an in-depth analysis of the motivation

strategies used by head teachers to motivate teachers and sustain the interest in participating in ICT integration.

5.4.4.1.   Sub-theme: Motivation strategies for ICT integration

In response to the interview question: How do you motivate your teachers to sustain interest in ICT integration?; the responses were fairly similar from all the 12 respondent who indicate that they make efforts to emotionally support teacher for ICT by encouragement to and incentives; they hold in-school workshops to cascade training such that the wider teacher community has at least the basic understanding of ICT use in education.

The transcribed response HTJ was:

"Through the school Parent Teachers Association (PTA) chairperson, my school has a contest where the best teacher in ICT integration is rewarded with a laptop. This has created a lot of interest in ICT where a number of teachers conduct extra lessons during school holidays through social media platforms. This has really helped in improvement of the school performance in the sub-county"

It is evident that in some schools, PTAs contributed to enhancing ICT-integration interest in teachers by instituting reward programmes for the most effective teachers in this field. This implies that the engagement of parents and the wider school community in encouraging use of ICT leads to improved implementation of ICT in Education.

Teachers' confidence in ICT integration in classroom has the potential of creating psychological readiness in continued use of ICT by teachers. This has the potential of improving the interest of teachers in harnessing advanced ICT skills leading to improved and innovative teaching and learning process.

5.5. DESCRIPTION OF DOCUMENTS ANALYZED

Numerous documents were analyzed but two in particular were singled-out due to their distinctive relevance to this study. They included:

- The National Education Sector Strategic Plans: these are education roadmaps that are planned for a period of 5 years. For this study the 2018-2022 NESSP was considered; and

- Curriculum Guide For ICT Integration in Education: A harmonized curriculum for Integration of ICT in Teaching and Learning for the purpose of the rollout of the National Laptops Project 2013 by the TSC.

The documents were accessed from the websites of the various government Ministries and related agencies forming the community of stakeholder in education. These stakeholders included the MOE and its state agencies of TSC and KICD; the MoICT and other opensource articles (https://www.education.go.ke ›)

5.5.1. The NESSP 2018-2022

An excerpt from the NESSP reads:

Integrate ICT in teaching, learning and assessment in primary education The government has continually invested in ICT integration in education to enhance access, quality and equity in education. There are various initiatives in ICT integration in education by both the government and other stakeholders. Key among these is the Digital Literacy Programme (DLP), which targets all public primary schools. In this programme, each school is provided with digital resources for effective curriculum delivery. It is currently facing a number of challenges. For instance, the use of tablets has been hampered by unreliable electricity supply, unreliable and/or lack of internet connection, lack of ICT skills among teachers, unwillingness of teachers to integrate ICT in teaching and learning, and sustainability of the programme. Going forward, there is need to deal with these challenges and scale up the DLP to include upper classes. This leverages on the current Digital Learning to enhance the use of ICT in teaching and learning in primary schools. To integrate ICT in teaching, learning and assessment in primary education, the following activities will be undertaken:

- *Undertake a digital literacy evaluation survey in all public primary schools;*
- *Construct computer laboratory in public primary schools;*
- *Equip all public primary schools with hardware and software infrastructure for ICT education;*
- *Build capacity of ICT champion teachers in integration of ICT in teaching, learning, assessment and management;*
- *Develop digital content for all subjects of the CBC for primary schools;*
- *Build capacity of head teachers for skills in ICT integration in teaching, learning and management; and*
- *Establish an ICT integration in education support system at the national, county, subcounty and institutional level.*

From the responses of both teacher and head teacher in this study, it is evident that many of these areas stipulated by the NESSP as priority activities were not achieved. Notably, these include: building capacity for teacher in integration of ICT; and establishing a support system for ICT integration in schools.

5.5.2. Curriculum Guide For ICT Integration in Education: A harmonized curriculum for Integration of ICT in Teaching and Learning for the purpose of the rollout of the National Laptops Project 2013 - TSC.

In it's introduction, the guide states:

This curriculum guide has been developed to assist the education implementers to integrate ICTs in primary education. The guide outlines the competencies, skills and attitudes to be developed in preparation for integrating ICTs in schools. The curriculum guide includes ICTs in Education and ICT integration in teaching and learning.

It is the Commission's (TSC) plan to have all or most of the teachers trained in the integration of ICT in education by 2016. Thereafter, all teachers entering the teaching profession will be expected to have taken as a unit of study at college, the integration of ICT in education. In this regard this manual will be available for use by teacher training colleges.

This study clearly reveals that the goals set out in this guidelines document were not achieved. The teachers' response regarding training on ICT integration irradiates the inconsistency between what is planned and on paper and what the teachers are experiencing on the ground.

5.6. SUMMARY OF THE CHAPTER

The chapter presented the qualitative findings from the interviews with the head teachers as well as the documents analysed. The responses were clustered in themes and sub-themes which were linked to the research questions and were illustrated by quotations from the head teachers. The next chapter will discusses the findings and triangulates the quantitative and qualitative findings with the literature.

CHAPTER SIX

DISCUSSION OF THE RESEARCH FINDINGS AND TRIANGULATION WITH LITERATURE REVIEWED

6.1. INTRODUCTION

This chapter presents the triangulated results of the quantitative and qualitative sections of the study. The study used a mixed-method approach where quantitative and qualitative data was collected and analysed from the participants' views and experiences on teacher support in ICT use in primary schools. The use of this approach enhanced the findings of the study, mitigating the weaknesses of both quantitative by virtue of the fact that they complimented and established each other's claims. The context of these results was the following research questions:

- What are the existing teachers support structures for effective implementation of ICT in Kenya primary schools?
- How effective are these support structures in teaching and learning with ICT?
- What are the expressed gaps in teacher support for ICT in the classroom environment?
- How can the teachers' interest and skills in ICT use be sustained in Kenya primary schools?

6.2. EXISTING TEACHERS' SUPPORT STRUCTURES FOR EFFECTIVE IMPLEMENTATION OF ICT IN KENYA PRIMARY SCHOOLS

The quantitative results from teachers and the qualitative findings from head teachers including documents analysed indicated that there are several existing teachers support structures to enhance their effective ICT implementation. However, these structures were stipulated in policies and strategy documents but rarely practised in-school. Where schools had written statements on the use of ICT for pedagogical purposes, this was undermined by poor technical expertise in teacher use of ICT. The findings supported UNESCO (2012:34) (Section 2.3) which opined that for success in integration of ICT in teaching and learning activities, teachers need to embrace the integration of ICT in their teaching methodologies to empower learners to respond creatively to a globalised world. The findings also supported Park (2016:11) (Section 2.5) who added that teachers' role in supporting ICT integration in curriculum include

evaluating ICT tools, assessing ICT competencies of learners, setting clear expectations, negotiating objectives with learners, and preparing learners for lessons by adopting various scaffolding strategies. This infers that teachers remain a critical variable in the process of ICT as their effective involvement can make or break the entire process of ICT integration.

It is notable that consensus exists concerning the teacher support structures for effective ICT implementation in schools. A few schools had the MOE policy on integration adopted and unpacked for teachers contextual understanding and application. It was also evident that the there was a positive significant correlation coefficient between effective implementation of ICT and presence of written statements explaining use of ICT. There was a positive and significant correlation between effective implementation of ICT and operation of specific ICT policy for teachers. A strong association existed between effective implementation of ICT and presence of regular discussions with teachers on ICT use. It is evident that teacher support structures contribute about 23% variance of the overall effectiveness of implementation of ICT when other factors are held constant. These findings support the sentiments by Motene (2016:2) (Section 2.3.3.1) who revealed that capacitation of teachers was crucial in enhancing the foundation for ICT integration into teaching and learning process.

In general, teachers agree that they need various structures to support their effective implementation of ICT in schools and which include: written document including MOE policies that they can refer to: in-school workshops that support peer-to-peer learning; incentivisation for teacher using ICTs; having designated ICT Champions as the go-to-teacher who would support others; access to adequate ICT infrastructure; and periodic training to continuously improve and update teachers skills in use of ICT in schools. The latter is particularly critical due to constantly changing technologies for education.

An astounding majority of respondent (97.8%) indicated that access to the requisite ICT infrastructure results in increased expertise for effective implementation of ICT. Only an insignificant number (2.2%) placed no value in access to ICT infrastructure. For acquiring updated expertise on ICT implementation, periodic and structured professional development training of teachers also highly regarded with 97% of teachers agreeing and on 3% disagreeing. Qualitative results showed that head-teachers are the supreme authority in the school and are relied upon by the government, teachers and learners in creating awareness and support for use of ICT in classroom teaching and learning process (Taban et al., 2013:1-3) (Section 2.5).

Therefore, the head-teachers were aware of the importance of the integration of ICT in the teaching/learning process. However, their optimal support can only be achieved if schools were well equipped with relevant infrastructure for ICT implementation. It was evident that head-teachers supported the ICT integration process in various ways to complement the support from the government and other stakeholders. Consequently, in schools where ICT integration was successful, the leadership of the school was heavily engaged in unpacking policies and spearheading training of teachers.

Engaging ICT Champions and regular in-school workshops were highlighted as critical to teachers' capacity to effectively implement ICT. This in line with Network Society Theory as postulated by Levinsen (2011) (Section 2.9.1) which endorses the formation of network communities of stakeholders by the head-teacher and the use of such platforms for ICT integration in the school. The theory supports the acquisition, sharing and distribution of ICT knowledge to all the teachers so that they have the capacity to apply ICT in classroom teaching. The results of this study confirmed the need for teachers to form social networks that have the potential of further creating wider platforms for accessing resources such as ICT skills for teachers. As indicated by Castells (2000:350) (Section 2.9.1), these networks ensure the social inclusion of teachers into global networks for the accumulation and the flow of ICT skills and information into the classroom.

6.3. EFFECTIVENESS OF THE TEACHERS' SUPPORT STRUCTURES FOR ICT IN TEACHING AND LEARNING PROCESSES

On the effectiveness of the teacher support structures for ICT in teaching and learning processes, the study identified a number of structures that will effectively support teachers and which include: availability of written statements explaining general and pedagogical use of ICT which to be used as quick reference documents; contextualised Policies on ICT integration which simplifies policies for easier understanding by teachers; regular in-school workshops for teachers peer to peer learning; incentivisation of teachers who use ICT's effectively; establishing an ICT-in-Education department with designated teachers to champion ICT; adequate access by teachers to the requisite ICT infrastructure; and structured regular professional development training of teachers on ICT implementation.

Regarding ICT infrastructure, while numerous documents in the literature review indicated that Kenya primary school had sufficient ICT devices with the DLP initiative, the study demonstrated that teachers lacked sufficient ICT hardware like projectors to supporting whole-class ICT teaching and learning process. Schools also had an insufficient number of teachers laptops and technical support for teachers to support ICT teaching and learning process.

Insufficient teachers ICT skills evident in this study is aligned to Mwambene and Luneta (2015:4) (Section 2.6) who stated that the challenge in primary schools especially in developing countries like Kenya was the problem of a lack of ICT resources coupled with limited skills by the teachers. This implies that for successful integration of ICT in teaching and learning process in Kenyan schools, availability of ICT-related infrastructure and training, are critical. It was evident that there was a positive significant correlation coefficient between insufficient number of computers to support ICT teaching and learning process.

There was a positive and significant correlation between insufficient number of Internet-connected computers to support ICT teaching and learning process and effective implementation of ICT. It was evident that teacher support for ICT teaching and learning process contributed about 60% of the variance of the overall effectiveness of implementation of ICT when other factors were held constant. There was a positive and significant relationship between teacher support for ICT teaching and learning process and effective implementation of ICT. This means that any improvement in teacher support for ICT teaching and learning process increases effective implementation of ICT.

Qualitative results demonstrated that most head teachers were sensitised on their role of ensuring that requisite support was given to the teachers for them to effectively implement the integration of ICT in the curriculum. In so doing the head teacher needed to comply with the requirements as set by the MOE through the KICD for integration of ICT in enriching the teaching-learning process. One requirement indicated is that head teacher provide or facilitate practical support to the teachers to ensure that ICT integration in the school is implemented and to enhance the skills and general ability of the teachers to have the capacity for and interest in ICT integration. Material and moral support is needed to ensure that the teachers will integrate ICT into their teaching for the betterment of the learners and school performance. It was evident that there was scarcity of financial resources in schools and insufficient capacity

to support all the teachers to gain the necessary technical capability to effectively participate in ICT integration.

In addition, schools lacked the technical support for teachers for support of ICT teaching and learning process. It is thus important for teachers as the pivotal stakeholders in the ICT integration process to be equipped with the necessary support and motivation to participate in this process. The head-teachers supported the training of ICT champions in the schools who were important role players in identification of the training needs of the teachers. There is a correlation between the findings and the Diffusion of Innovations theory (Section 2.9.2). First, since it is not people who change, but the innovations themselves; the head-teacher and the teachers should continuously be exposed to the rapidly changing technology world. They need to have the knowledge of the current and continuously update ICT platforms that are best suited to support classroom teaching. Further, the theory proposes that an innovation (technology) is passed on from its source to end-users through a medium of agents, its diffusion to potential users is, for the most part, dependent on the personal attributes of the individual user. This calls for the linkages between the stakeholders in the education sector in Kenya to coordinate the flow of technology from the highest level of the education sector to the classroom teacher. Additionally, the theory assumes that the technology in question is appropriate for use unless hindered by the lack of effective communication (Negatu & Parikh, 1999:208) (Section 2.9.2). The implication is that barriers such as lack of technical support for teachers and insufficient ICT skills that hinder transmission of technology to the school and the teachers should be eliminated to pave the way for diffusion of technology and innovations. Lim (2014:56) (Section 2.6) advanced that there is need for planners at national level to put into practice policies geared towards creation of a shared vision and mission of ICT integration especially with teachers who will remain at the forefront to drive the ICT-integration agenda for teaching and learning.

6.4. GAPS IN TEACHERS' SUPPORT STRUCTURES FOR ICT IN THE CLASSROOM ENVIRONMENT

There were a few gaps in teacher support needs for ICT in classroom environment; for example, insufficient and outdated computers in the classrooms and frequent computer breakdowns that interrupted classroom teaching. The findings agreed with Taban et al. (2013:1-3) (Section 2.3) who postulated that the major barriers to effectiveness of the teacher support were lack of genuine software; inadequate computers in the classroom; low-speed internet; lack of

motivation from both teachers and learners to use ICT; lack of proper training skills; unavailability of latest ICT equipment; lack of expert technical staff; poor administrative support; and poor course curriculum. The findings also agreed with Mukhari (2016:23) (Section 2.2.3.1) that factors that hinder the effectiveness of the ICT integration were inadequate ICT infrastructure; teachers' lack of ICT skills and low level of ICT support for teachers; inadequate training; negative attitudes; and poor teacher confidence. The implication is that there is need to provide requisite ICT infrastructures for the integration process to be successful.

The findings further agree with Greer et al. (2016:20-22) (Section 2.8.1) that lack of access to ICT resources; inadequate ICT infrastructure; lack of effective training; inappropriate organisation; technical problems; lack of vision and mission about the significance of ICT in teaching and learning; and poor leadership are school-level barriers. The findings also supported the assertion by Hart and Laher (2015:2) (Section 2.8.1) who identified lack of access to computers in schools; lack of software and technical support for teachers; insufficient teacher training on ICT; lack of internet access; lack of reliable electricity supply; and lack of parent and community involvement as barriers to the use of ICT in schools.

There was a positive significant correlation coefficient between investment in adequate instruction time for ICT in teaching methodologies and effective implementation of ICT. There was a positive and significant correlation between adequate computers in the classrooms and effective implementation of ICT. The implication of these findings is that reducing the gaps in teacher support needs for ICT contributes about 50% of the variance in the overall effectiveness of implementation of ICT. This further implies that there is a positive and significant relationship between gaps in teacher support needs for ICT and effective implementation of ICT. This means that any improvement in gaps in teacher support needs for ICT would increase effective implementation of ICT.

Qualitative results showed that identification of the training needs of the teachers is an important milestone in ensuring that they have the requisite skills for the learning process. It is the responsibility of the head-teachers to create appropriate understanding of the training needs of the teachers for translation of this knowledge to the necessary stakeholders for training gaps to be identified and training to be implemented. It is also the duty of the head teacher to create avenues for the teachers to participate in integration of ICT in the schools. The head teacher

has to use such avenues to properly diagnose the gaps in teachers' mastery of ICT process and to effectively provide remedies to address these ICT-related literacy gaps.

It is also notable that the attitude of teachers towards use of computers remain wanting. The older teachers were uncomfortable with adopting new ways of teaching and did not deem it useful for them as they were about to retire. The preferred in using the traditional classroom teaching techniques which they had employed during their teaching career. It was noted that the majority of the teachers in primary schools were aware of the MOE's policy of ICT integration in the curriculum. Teachers had interacted with ICT programmes especially in schools where there were external projects being implemented with development partners.. Through the DLP, schools had sent teachers to seminars and workshops and some ICT champion in the school organised in-service training for teachers to improve their ICT skills.

As proposed by Rogers (1983) (Section 2.9.2), there are four major factors that influence diffusion process: the innovation itself, communication, time and nature of the social system into which the technology is being introduced. The implications as far as the results are concerned is that since teachers have interacted with the recommended technology and several of them are already applying it in classroom teaching, the innovation is relevant for integration. In terms of communication, teachers regularly used the existing technological platforms to communicate with the employer (TSC) and other education stakeholders in Kenya. A number of teachers had also easily adopted the innovations recommended for practical teaching and learning. This means that the integration of technology is timely and useful in the current classroom settings. The social system in many schools however, may not allow for effective ICT integration as evident in the study due to the absence of basic amenities like reliable internet and electricity. However, the situation is rapidly changing in Kenya with on-grid electricity deployment to public primary schools across the country. Solar solutions are also being deployed to some of the schools. Internet connectivity and penetration has also experienced a major boost with various alternative services distributed to the majority of rural regions in Kenya.

Given the nature of human beings' inclination to resist change coupled with the fact that integration of ICT in basic education is a recent development in Kenya, it may take some time to change the mindset of the teachers to abandon traditional methods in favour of ICT-enabled learner-centred approaches. This shift is possible with continuous support to teachers in ICT

integration by the stakeholders by eliminating the barriers that inhibit effective teacher support structures for implementation of ICT in schools.

6.5. STRATEGIES FOR SUSTAINING TEACHERS' INTEREST AND SKILLS IN ICT

Results on the mechanisms for sustaining teachers' interest and skills in ICT showed that rarely do schools have sufficient, well-trained teachers. It is evident that the numbers of well-trained teachers on ICT integration has a significant contribute to overall effective implementation of ICT in schools. The findings support Taban et al. (2013:12) (Section 2.5) who emphasised the necessity for effective preparedness of teachers for success in ICT integration in schools. Michael (2016:23) (Section 2.3) added that though there is heavy investment in ICT in the education sector, the need for integration is yet to filter through to all the teachers, leading to challenges in ICT teaching and learning process which has lagged behind the other sectors of the economy. Additionally, the availability of computers to support teachers with ICT integration cannot be overemphasized as is evident in the findings of this study that it would contribute in sustaining teachers interest and expertise in ICT integration.

There was a positive significant correlation between the supply of well-trained teachers on ICT use and effective implementation of ICT. There was a positive and significant correlation between teachers' positive attitudes towards ICT use in classroom teaching and effective implementation of ICT. The implication is that mechanisms for sustaining teachers' interest and skills in ICT contributes about 53.5% of the variance in the overall effectiveness of implementation of ICT. This means that any improvement in mechanisms for sustaining teachers' interest and skills in ICT increases effective implementation of ICT by a factor of 66.4%.

From the qualitative results, it is evident that building teachers' confidence in ICT integration in classroom teaching has the potential of creating psychological readiness in use of ICT. This has the potential of improving the interest of teachers in harnessing their computer literacy skills leading to improvements in the computer-driven teaching and learning process. Motivated teachers have the tendency to adopt ICT in classroom teaching leading to improvements in the school performance.

As proposed by Network Society Theory, the role of ICTs, especially the internet is to disseminate knowledge, information and power in order to make people knowledgeable and better human beings and to make the world they live in a better place. As such, teachers as critical stakeholders in the integration process should be motivated to have an interest in participating in this important endeavour. Motivation should be both material and psychological where rewards and encouragement are combined to create the impetus to fully participate in the process.

Additionally, Castells and Cardoso (2005:4) (Section 2.9.1) and Levinsen (2011:52) (Section 2.9.1) in support of the theory argued that in order for society to survive in the network society, it must have a self-directed labour force of highly educated people who are creative problem-solvers, critical thinkers, leaders, knowledge constructors and collaborators. Thus, all stakeholders in the education sector should support the process of equipping teachers with ICT skills to creatively apply the same in classroom towards moulding leaners with critical thinking and innovation capabilities.

6.6. SUMMARY OF THE CHAPTER

Chapter 6 discussed and presented the results of both quantitative and qualitative analysis. This was important because this study used a mixed methods approach where quantitative data was collected and analysed and the same done to qualitative data collected. The chapter also presented triangulation and discussion of the findings of the different data-set to ensure a holistic perspective and enhance credibility regarding teachers' support structures for effective implementation of ICT in Kenya primary schools. The next Chapter summarises the findings of this study, draws conclusions and makes recommendations.

CHAPTER SEVEN

SUMMARY OF RESEARCH FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

7.1. INTRODUCTION

This final chapter presents the summary of the findings, conclusions and recommendations of the study. First, the summary of the study chapters is presented as well as the summary of the main findings. Secondly, the limitations of the study are explained followed by the conclusions. Thirdly, the chapter presents an account of the new thinking that the study has contributed to the body of knowledge. It concludes by spelling out recommendations made to various stakeholders followed by suggested further studies that could compliment this study.

7.2. PURPOSE OF THE STUDY

The purpose of this research was to interrogate teacher support structures for effective implementation of ICT in Kenya primary schools to ultimately achieve improved learning outcomes. The study sought to fulfil the following objectives:

- To establish existing teacher support structures for effective implementation of ICT in the Kenya primary schools.
- To determine teacher support for ICT in teaching and learning process for effective implementation of ICT in the Kenya primary schools.
- To establish gaps in teacher support needs for ICT in the classroom environment for effective implementation of ICT in the Kenya primary schools.
- To assess the mechanisms for sustaining teachers' interest and skills for effective implementation of ICT in the Kenya primary schools.

7.3. SUMMARY OF THE CHAPTERS

Chapter 1 provided the introduction of the study and highlighted the importance of undertaking the study. The background information of the study illuminated the importance of integrating ICTs in education systems and the efforts made globally, in Africa and in Kenya.

The problem statement, research questions, aim and objectives of the study were accentuated in this chapter. An account of the research methodology employed was included in the chapter which ended with a definition of the key terms relating to the study.

Chapter 2 introduced the literature review on ICT use in general and specifically in teaching and learning. It presented the efforts made towards teacher support to integrate ICT in primary schools learning environment. A review of ICT-in-education comparing global and regional approaches was also presented in this chapter. Various endeavours for effective sustenance of teachers' interest and skills in ICT were highlighted. The chapter also examined the theories and the theoretical framework underpinning the integration of ICTs in basic education. The theories in the study were the Network Society Theory and Diffusion Innovation Theory which were examined in terms of ICT use in the learning processes and teacher support structures.

Chapter 3 explicated the research methodology appropriate in the study. It focused on population and sampling, the research site, instruments for data collection which were questionnaires, interview guides and documentary reviews. It went on to deal with the analysis of data, validity and trustworthiness of the study and how the data would be analysed. Finally, the chapter considered the ethical issues related to the study.

Chapter 4 presented results of the quantitative data analysis based on selected statistical techniques. Interpretation and presentations of the findings of the quantitative data analysed was also undertaken.

Chapter 5 presented the findings of the qualitative data analysis emanating from themes and sub-themes generated. Profiling of the participants and results of document analysis were included.

Chapter 6 presented the data analysis and interpretation of the quantitative data from the teachers, qualitative from the head teachers and documentary review undertaken. The chapter also presented triangulation and discussion of the findings of the different data-set to ensure a holistic perspective and enhance credibility on findings regarding teacher support structures for effective implementation of ICT in Kenya primary schools.

Chapter 7, being the last presents a summary of the findings, draws conclusions, suggests recommendations to various stakeholders and provides potential future studies that could complement this study.

7.4. SUMMARY OF THE METHODOLOGY

This study was underpinned by the interpretive epistemological paradigm. The interpretivist approach provided the participants with the opportunity to be heard and to gain insight and in-depth information on the entire research. The interpretivist paradigm is concerned with uncovering and explaining teachers' support structures on ICT use in teaching and learning in the school environment in Kenya. Additionally, primary-school teachers' support structures for effective implementation of ICT in Kenya primary schools were better understood through direct interaction with some of the participants at their workplaces, the school.

The nature of the research problem dictates the research approach which the researcher must use in order to obtain the information necessary to answer the main research questions and the subsequent questions. This study used a mixed-method approach since quantitative and qualitative data was collected from the participants' views and experiences on teacher-support in ICT use in primary schools. The use of this approach was complementary and minimised weaknesses of both the quantitative and qualitative approaches. Concurrent Transformative Research design was adopted in this study with both quantitative and qualitative data collected concurrently.

A quantitative approach was employed since the focus was on gathering numerical data through questionnaires on the support structures for practical ICT integration in schools. Documentary reviews from school documents related to support given to teachers on ICT integration in schools were also used to assist in acquisition of quantitative data. A qualitative research approach was also used since the intention was to gain knowledge of the views and experiences of the head-teachers (key informants) on the support structures provided to the teachers. Other document obtained from the MOE and other sources were also reviewed and their data presented as a quantitative sub-set.

Two probability sampling techniques were used in this study; stratified and proportionate stratified sampling. The study used the sampling techniques as follows; firstly, stratified

sampling technique was used to divide the population into four strata, according to the four selected Kenya counties of Kajiado Kilifi, Nairobi and Uasin Gishu. There was a total of 604 primary schools and 3,400 primary-school teachers in the four counties. Secondly, proportionate stratified sampling was used to select representative samples of participants from the schools in the four counties. There were 60 sub-countries in the four selected counties. Purposive sampling was used to select the 12 participants for the interviews. The final sample size was 352 respondents.

In this study, questionnaires for primary-school teachers, semi-structured interview for head-teachers and document analysis formed the main data collection strategies. The 12 head-teachers were key informants in the in-depth interviews. In addition, document analysis was conducted comprising of an evaluation of existing documents relating to support structures given to teachers on ICT integration. The documents for review included the ICT education policy documents available in schools, guidelines for schools ICT hardware specifications, newspaper articles and reports on ICT use in Kenyan schools. These documents were accessed from the library at the MOE in Nairobi, Kenya, the website of the ministry as well as other open-source articles.

In data analysis, linear regression using descriptive and inferential statistics analysis was used to meet the objectives 1 and 2 of the study: to determine existing teachers' support structures for teachers in Kenya primary schools and the determine the effectiveness of teachers' support for ICT in teaching and learning being offered. Descriptive and inferential statistics were also used to present the variables while showing the means and standard deviations of use of the various strategies and the level of effectiveness. For research question 3 and 4 expressed gaps in teachers' support needs for ICT and sustenance of teacher interest and skills in ICT descriptive and inferential statistics were used. Qualitative data analysis involved the creation of themes and sub-themes from the interview data.

7.5. SUMMARY OF THE MAIN FINDINGS

The summary of the main findings is presented under the following themes: demographic data; existing teachers' support structures for effective implementation of ICT; effectiveness of teachers' support structures for ICT in teaching and learning process for implementation of ICT; and gaps in teachers' support structures for ICT in the classroom environment for

effective implementation of ICT, and strategies for sustaining teachers' interest and skills for effective implementation of ICT.

7.5.1. Demographic Data/Information

The target respondents-population was 352 participants who comprised of public primary-school head-teachers and teachers in four Kenyan counties of Kajiado Kilifi, Nairobi and Uasin Gishu. In total 285 participants responded representing 80.9% response rate. It was established that a slight majority of the respondents were male teachers accounting for 52% of the population. Female teachers realised a 48% total of the population. In addition, the majority of teachers had a Primary 1 Certificate and 23.5% had a basic qualification in ICT.

Further, it was revealed that 49.1% were class teachers while 43.2% were acting in discipline committees in their respective schools. However, there were very few computer teachers comprising only 7.7%. It was also established that a number of teachers in public primary schools in Kilifi, Uasin Gishu, Kajiado and Nairobi counties in Kenya have been sponsored for training either by the school or Ministry of Education. Results on the length of service in the respective school indicated that 39% of the teachers had stayed in the school for 5-10 years, 28% had 1-5 years and 21% of the teachers had over 10 years in the same school. Only about 11% had less than one year in the school.

Qualitatively, results on qualifications showed that 41.7% of head teachers were holders of a Bachelor in Education degree while 33.3% had Master's in Education degrees. In terms of length of service in current school, 58.3 % had 1–5 years while 25% had 5–10 years. Additionally, 23.5% had some basic qualifications in ICT.

The documents analysed included ICT education policy documents, guidelines for schools ICT hardware specifications, and Policy Documents, National Education Strategy Plans, and reports on ICT use in Kenyan schools. These documents were in public domain and therefore easily accessible for downloading for various state agencies' websites.

7.5.2. Existing Teachers' Support Structures and their effectiveness for ICT implementation in schools

The findings established that public primary schools in Kenya had various structures at varied levels of implementation. These included: head teachers in few schools had made available written statements explaining general and pedagogical use of ICT which the teacher would refer to in the course of their in duty; a few schools had adopted and unpacked MOE's Policy on ICT integration such that it was easily understood by teachers in-school which supported their efforts in ICT implementation in school; some schools convened regular in-school workshops for teachers on effective use of ICT which resulted in increased expertise on ICT teaching methodologies in the various subject areas; some schools instituted incentivization programs to motivate teachers who used ICT in order reinforces the behaviour and encourage other teachers; some schools stablished ICT-in-Education departments with designated teachers to champion ICT in the school which provided support to all other teachers; access to requisite ICT infrastructure was established as critical element in supporting teachers for their effective implementation of ICT; and lastly, periodic and structured professional development training of teachers on ICT implementation was regarded as critical as it would update and increase expertise for implementation of ICT in the schools

The findings indicated that there were existing structures which could support teachers with ICT integration if they were adopted and used restaurant. In general, teachers agree that they need various structures to support their effective implementation of ICT in schools. These included: written document including MOE policies that they can refer to: in-school workshops that support peer-to-peer learning; incentivisation for teacher using ICTs; and having designated ICT Champions as the go-to-teacher who would support others.

7.5.3. Gaps in Teachers' Support structures for ICT in the classroom

The findings established that schools had gaps hindering the integration of ICT. For instance, schools had insufficient computers and lack sufficient training of teachers on ICT use. The findings further revealed that factors hindering effectiveness of the ICT integration were inadequate ICT infrastructure, teachers' lack of ICT skills and low level of ICT support for teachers, inadequate training, negative attitudes and poor teacher confidence. Another identified gap was that motivation of teachers on use ICT in classroom teaching has led to

psychological readiness in use of ICT by teachers. In addition, it was established that some teachers were still not confident in handling computers in the classroom. These were mostly older teachers, nearing retirement, who were unwilling to transition from using traditional classroom teaching techniques to digital pedagogy. It was notable that the majority of the teachers in primary schools were aware of the existent of MOE policy on ICT integration in the curriculum although most of them could not identify with its operationalisation.

7.5.4. Enhancing Teachers' Interest and Skills in ICT Integration

The findings showed that teachers in public primary schools had negative sentiments on the effort being done to accomplish the objective of integration. This was despite the presence of a reliable power supply and teachers ready to embrace and support ICT use in classroom teaching. The findings also established that creating teachers' confidence in ICT integration in classroom teaching has the potential to create psychological readiness in use of ICT.

7.6. LIMITATIONS OF THE STUDY

Despite careful planning on the parameters of conducting this study, pitfalls were encountered on the way. First, consistency in collection of the qualitative and quantitative data was not fully adhered to. In most cases, respondents were willing to provide their views on the questionnaires but were not ready to participate in interviews for more grounded opinions. On numerous visits, to the schools, appointments were rescheduled due to unavailability of teachers or commitment to schoolwork resulting in a waste of time and finances. However, with my persistence, the qualitative data was finally collected.

7.7. DELIMITATIONS OF THE STUDY

The study was conducted in four selected counties of Kajiado, Kilifi, Nairobi and Uasin Gishu in Kenya. Due to limitation of time and financial resources, I could not scale the study to cover a wider geographical reach in Kenya but I ensured that the sample provide a fair representation of the wider country. I further narrowed the scope to 352 respondents who comprised of head-teachers and teachers. The use of teachers was to minimise the bias from head-teachers on responses related to integration of ICT in schools. The study incorporated a two-phase model which comprised both the qualitative and quantitative approaches and occurred in different time periods. These delimitations need to be taken into context when generalising the results of this study.

7.8. CONCLUSIONS

The purpose of this study was to investigate the teachers' support structures for effective ICT integration in public primary schools in Kenya. For ICT integration to be effective in the teaching and learning process, it needs to be supported by education and school policies and effective professional development for teachers. Thus, the study concluded that stakeholders should put effort into availing all the required resources for ensuring teachers are supported in the ICT integration process in the schools. It was established that the existing structures were not effective in supporting teachers for ICT integration in the teaching and learning processes in public primary schools in Kenya. This led to the conclusion that teachers' support structures should be enhanced and supported with tangible and effective ICT integration resources such as material and motivational strategies.

The findings on mechanisms for sustaining teachers' interest and skills in ICT showed that teachers in public primary schools had negative sentiments on the efforts being made to accomplish this noble objective. This is because schools do not have sufficient teachers who are well-trained on ICT use. This led to the conclusion that obstacles that hinder the motivation of teachers and effectiveness in ICT integration should be solved for the success of the process. The study concluded that while the barriers that prevent teachers from effectively using ICT are immense, they are in not insurmountable and therefore every effort should be made to upskill and motivate teachers to transition to a mindset that regards ICT as an integral enabler of teaching and learning in the 21st century.

7.9. CONTRIBUTION TO KNOWLEDGE

The new knowledge that this study has contributed is in identifying three 'quick-win-actions' towards improving teachers' support structures for ICT-in-Education as follows: (i) provision of continuous ICT in teaching skills on demand; (ii) re-designing ways to motivate teachers with continuous in-system incentivisation and recognition of exemplary practice; and (iii) formally mainstream the establishment of at least two ICT champion teachers in each primary school. The champion teachers would be the focal points of knowledge, innovation and skills diffusion, holding regular for a to continuously link policy-makers to policy-implementers in a strategic manner.

In summary, this study articulates the contribution to new knowledge in Figure 7.1 below. To improve teachers' support structures for effective implementation of ICT in public primary schools, this study proposes that it is imperative for the:

- **MoE** to ensure that there is no disconnect between policies and in-school practice regarding ICT implementation. The policy document must align to the realities in the schools in terms of the requisite ICT infrastructure and training programmes for teachers.

- **School leadership** to guarantee a level motivation for teachers to engaged ICT in their teaching activities by instituting inspiring strategies which may include award and recognition of promising practices; keeping abreast with emerging trends and sharing the same with teachers; and identifying and exploiting any skill-building opportunities that are available online or otherwise.

- **Teachers** to recognise and appreciate that ICT is sine qua non for effective teaching going forward. In view of the fact that ICT has permeated every aspect of our life, its implementation in education is not a question of 'if' but of 'how'. It is therefore incumbent upon all teachers to make personal efforts to align with the future of education by 'being on the look-out' for any training opportunity to take up and put the skills into practice in the classroom teaching and management.

- **Parents and wider school communities** have the responsibility to morally and materially support teachers with ICT implementation. This could be through the PTAs who would: invest in incentivisation of 'good-practice' teachers; and support in securing, maintaining and ensuring security of the ICT infrastructure; and engage in cascading any training skills wherever possible.

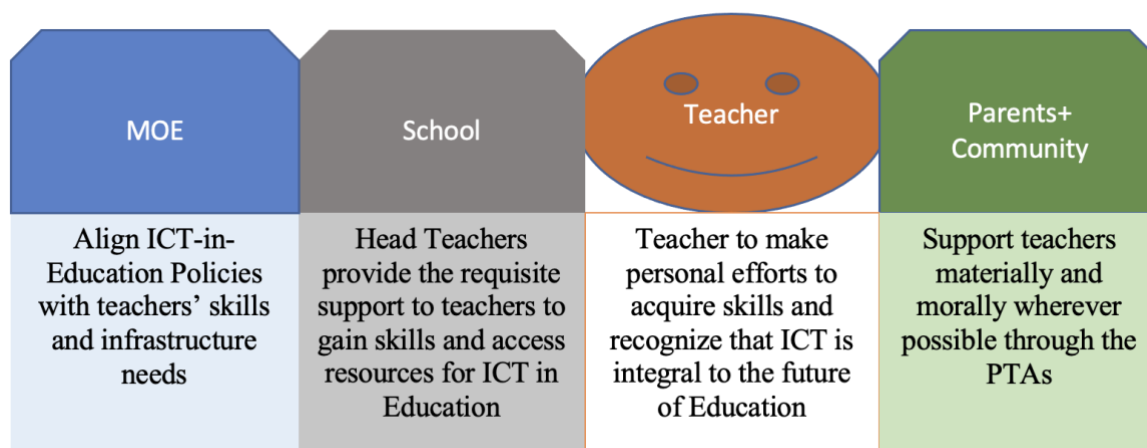| MOE	School	Teacher	Parents+ Community
Align ICT-in-Education Policies with teachers' skills and infrastructure needs	Head Teachers provide the requisite support to teachers to gain skills and access resources for ICT in Education	Teacher to make personal efforts to acquire skills and recognize that ICT is integral to the future of Education	Support teachers materially and morally wherever possible through the PTAs

Figure 7.1. Teachers' Support Structures for Effective ICT Implementation

7.10. RECOMMENDATIONS

7.10.1. Recommendations to Policy-Makers

Motivation of teachers to sustain abilities and interest in ICT-in-Education should be considered as a policy item. This would include a more robust networking strategies for teachers in ICT-in-Education. This calls for stakeholders such as the MOE, Teacher Service Commission, Non-Governmental Organisations and KICD to organise platforms for incentivising and recognising promising practices by individual teachers while enabling a community of practice. It is recommended that the stakeholders, whether in the private or public space, make a concerted effort to carefully consider existing models of teachers' support structures within small-scale initiatives in Kenya.

Perhaps the apogee of this study is a clarion call to shift the focus from development of new policies to practice. It is evident that there are many documents stipulating teacher-support for ICT integration but there is a major disconnect with the practice of it in-schools. The MOE should come up with specific subject-aligned activities that will see ICT reduce teachers' workload and ensure optimal efficacy of technology with regards to learning outcomes.
The MOE must consider streamlining: (i) continuous comprehensive ICT-in-Education skills training; (ii) teacher support-on-demand platform that is specific to each subject for ICT integration; and (iii) provision of requisite materials and equipment to teachers.

The focus must shift from policy to practice.

7.10.2. Recommendations to Primary Schools in Kenya

It is the recommendation of this research that at school level, the stakeholders including PTAs, Boards of Management, Head Teachers and even teachers themselves, seize every possible opportunity and adopt models that are working in other schools. While a lot depends on the Ministry, this study has highlighted a few schools and head teachers who have gone a long way in making efforts to improve both skills and infrastructure for ICT in their school.

7.11.   RECOMMENDATIONS FOR FUTURE RESEARCH

Future studies in line with this study would need to be conducted and may include:

1) Since the areas of ICT integration in education is very broad, other interesting and related studies would include:

   a) The Disconnect Between Policy and Practice in ICT-Integration-in Education: A case for Kenya (or any other country)

   b) The effect of constantly changing technologies on the efforts of teachers to implement ICT-Integration in public schools: The case of Kenya (or any other country)

2) Since the overall goal for this study was to investigate the teachers' support structures for ICT integration in public primary schools, future studies should include public secondary schools in Kenya and in other countries.

3) Research could also be undertaken to identify successful teachers' support structures that could inform the way forward in mitigating the challenges identified in this research.

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APPENDICES

APPENDIX 1: UNISA ETHICAL CLEARANCE

UNISA | university of south africa

UNISA COLLEGE OF EDUCATION ETHICS REVIEW COMMITTEE

Date: 2019/10/16

Ref: **2019/10/16/47196254/08/MC**
Name: Ms CW Kariuki-Thuo
Student No.: 47196254

Dear Ms Kariuki-Thuo

Decision: Ethics Approval from
2019/10/16 to 2024/10/16

Researcher(s): Name: Ms CW Kariuki-Thuo
E-mail address: 6142605@mylife.unisa.ac.za
Telephone: +27 83 318 3855

Supervisor(s): Name: Prof SP Mokoena
E-mail address: tnelnm@unisa.ac.za
Telephone: +27 83 660 9219

Title of research:

**INTERROGATING TEACHER SUPPORT STRUCTURES FOR EFFECTIVE
IMPLEMENTATION OF ICTS FOR EDUCATION IN KENYA PRIMARY SCHOOLS**

Qualification: D. Ed in Education Management

Thank you for the application for research ethics clearance by the UNISA College of Education Ethics Review Committee for the above mentioned research. Ethics approval is granted for the period 2019/10/16 to 2024/10/16.

The **low risk** application was reviewed by the Ethics Review Committee on 2019/10/16 in compliance with the UNISA Policy on Research Ethics and the Standard Operating Procedure on Research Ethics Risk Assessment.

The proposed research may now commence with the provisions that:
1. The researcher(s) will ensure that the research project adheres to the values and principles expressed in the UNISA Policy on Research Ethics.
2. Any adverse circumstance arising in the undertaking of the research project that is relevant to the ethicality of the study should be communicated in writing to the UNISA College of Education Ethics Review Committee.

University of South Africa
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APPENDIX 2: LETTER TO NATIONAL COMMISSION FOR SCIENCES, TECHNOLOGY AND INNOVATION (NACOSTI)

UNISA | university of south africa

TO THE DIRECTOR NACOSTI
P. O. Box 30623, 00100
NAIROBI, KENYA
Dear Sir/Madam

REF: PERMISSION TO CONDUCT RESEARCH IN SCHOOLS IN KENYA

My name is Catherine Wangeci Kariuki-Thuo, PhD student at the University of South Africa. I humbly request for a permit to conduct research in primary schools in Kenya. My research is on **"Interrogating teachers' support structures for effective implementation of information communication technologies in Kenya primary schools".** This study aims at interrogating teachers' support structures for effective implementation of ICT in Kenya primary schools.

I assure you that information collected in this research will purely be usable for academic purposes only. The identities of the respondents and information collected will be treated with utmost confidence.

Yours truly,
Catherine Wangeci Kariuki-Thuo

APPENDIX 3: PERMISSION TO CONDUCT RESEARCH

REPUBLIC OF KENYA

**NATIONAL COMMISSION FOR
SCIENCE, TECHNOLOGY & INNOVATION**

Ref No: 125259

Date of Issue: 22/April/2021

RESEARCH LICENSE

This is to Certify that Ms.. Catherine Wangeci Kariuki-Thuo of University of South Africa, has been licensed to conduct research in Kajiado, Kilifi, Nairobi, Uasin-Gishu on the topic: INTERROGATING TEACHER SUPPORT STRUCTURES FOR EFFECTIVE IMPLEMENTATION OF ICT IN KENYA PRIMARY SCHOOLS for the period ending : 22/April/2022.

License No: NACOSTI/P/21/7092

125259

Applicant Identification Number

Director General
NATIONAL COMMISSION FOR
SCIENCE, TECHNOLOGY &
INNOVATION

Verification QR Code

NOTE: This is a computer generated License. To verify the authenticity of this document,
Scan the QR Code using QR scanner application.

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APPENDIX 4: REQUESTING PERMISSION FROM THE COUNTRY DIRECTOR OF THE MINISTRY OF EDUCATION TO CONDUCT RESEARCH

UNISA | university of south africa

COUNTY DIRECTOR OF EDUCATION

MINISTRY OF EDUCATION

JOGOO HOUSE 'B'

2019 to 2021

Dear Sir/Madam,

RE: PERMISSION TO CONDUCT RESEARCH IN YOUR COUNTY'S PRIMARY SCHOOLS

I, Catherine Wangeci Kariuki-Thuo, doing research under supervision of Professor Sello Mokoena in the Department of Education towards a Doctorate of Philosophy Degree in Education Management at the University of South Africa. The research is entitled "Interrogating teachers' support structures for effective implementation of information communication technologies in Kenya primary schools".

I write to request permission to conduct research in public primary schools in (Kilifi, Uasin Gishu, Kajiado or Nairobi) County. The aim of the study is to highlight the ICT support structures given to teachers in the teaching and learning process in primary schools in Kenya. Your County has been selected because it has public primary schools that have been implementing ICT-in-Education.

The study will entail identifying and interrogating the teachers' support structures for optimal use of ICT to achieve improved learning outcomes and sustain their skills and interest in use of these technologies. The benefits of this study are that it will; identify the existing teachers' support structures in ICT in the local public primary schools and also highlight the support structures needed in improving ICT learning.

Please note that there are no risks involved in your County Schools' participating in this study as all respondents will remain anonymised.

A report on the findings of this study will be sent to the County Education Office.

Yours sincerely

Catherine Wangeci Kariuki-Thuo

Researcher

APPENDIX 5: INTRODUCTORY LETTER

Date: XXXX

Title: ASSESSING TEACHERS' SUPPORT STRUCTURES FOR EFFECTIVE IMPLEMENTATION OF ICTS FOR EDUCATION IN KENYA PRIMARY SCHOOLS

DEAR PROSPECTIVE PARTICIPANT

My name is Catherine Wangeci Kariuki-Thuo. I am doing research under the supervision of Prof. Sello Mokoena, a Professor in the Department of Education Leadership and Management towards a Doctorate of Philosophy Degree in Education Management at the University of South Africa. We are inviting you to participate in a study entitled INTERROGATING TEACHERS' SUPPORT STRUCTURES FOR EFFECTIVE IMPLEMENTATION OF ICTS FOR EDUCATION IN KENYA PRIMARY SCHOOLS towards a Doctorate of Philosophy Degree in Education Management.

WHAT IS THE PURPOSE OF THE STUDY?

This study is expected to collect important information that could: identify current ICT support structures for teachers in the use of ICTs in education for primary schools in Kenya; unpack gaps in the existing structures; and propose ways to improve teachers' support structures for effective use of ICT in Teaching and Learning. Your school has been selected because it is public primary schools.

WHY AM I BEING INVITED TO PARTICIPATE?
You are invited because your input as a Head Teacher/Teacher will shed more light into existing structures and also for sharing what gaps may exist in your teaching experience.

I obtained your contact details from randomly from the Teacher Service Commission. You are among 340 teachers selected for this exercise.

WHAT IS THE NATURE OF MY PARTICIPATION IN THIS STUDY?

Your role as the participant in this study will be to provide feedback on the questionnaire based on your experience in the use of ICT in your school. The study involves questionnaires (see attached) and interviews to teachers in the selected schools. The expected time to complete the questionnaire is about 60 minutes which can be done in the course of a week. The interview session will be a maximum of 45minutes.

CAN I WITHDRAW FROM THIS STUDY EVEN AFTER HAVING AGREED TO PARTICIPATE?

Participating in this study is voluntary and you are under no obligation to consent to participation. If you do decide to take part, you will be given this information sheet to keep and be asked to sign a written consent form. You are free to withdraw at any time and without giving a reason. However, you may note that in this study, neither your name nor any other identifying information will be associated with the responses, audio recording or the transcript. Your identity as a participant will be anonymous and what will be said during the interview will be kept in the strictest confidentiality.

WHAT ARE THE POTENTIAL BENEFITS OF TAKING PART IN THIS STUDY?

There will be no monetary compensation for participating in this study. However, it is important to note that the report of the findings of this research study will be communicated to you and it will make a significant contribution towards improving support structures for ICT-in-Education for all teachers in Kenya primary schools and beyond.

ARE THERE ANY NEGATIVE CONSEQUENCES FOR ME IF I PARTICIPATE IN THE RESEARCH PROJECT?

There will be no risk to your participation as you will remain anonymised.

WILL THE INFORMATION THAT I CONVEY TO THE RESEARCHER AND MY IDENTITY BE KEPT CONFIDENTIAL?

Your name will not be recorded anywhere and no one will be able to connect you to the answers you give. Your answers will be given a code number or a pseudonym and you will be referred to in this way in the data, any publications, or other research reporting methods such as conference proceedings.

A report of the study may be submitted for publication, but individual participants will not be identifiable in such a report.

HOW WILL THE RESEARCHER(S) PROTECT THE SECURITY OF DATA?

Hard copies of your answers will be stored by the researcher for a period of five years in a locked cupboard/filing cabinet in Nairobi, Kenya for future research or academic purposes; electronic information will be stored on a password protected cloud storage. Future use of the stored data will be subject to further Research Ethics Review and approval if applicable.

WILL I RECEIVE PAYMENT OR ANY INCENTIVES FOR PARTICIPATING IN THIS STUDY?

No payment will be made for participation in this study. The participant will be on voluntary basis after understanding the wider benefit of the study to the teaching fraternity. Participation will be made to coincide with school recess period such that it removes the burden of competing teaching tasks.

HAS THE STUDY RECEIVED ETHICS APPROVAL

This study has received written approval from the Research Ethics Review Committee of the College of Education, Unisa. A copy of the approval letter can be obtained from the researcher if you so wish.

HOW WILL I BE INFORMED OF THE FINDINGS/RESULTS OF THE RESEARCH?

If you would like to be informed of the final research findings, please contact, Catherine Wangeci Kariuki-Thuo on +254722762698 or email, cwangeshi@gmail.com The findings will be accessible from the third quarter of 2022.

Should you require any further information or want to contact the researcher about any aspect of this study, please contact Catherine Wangeci Kariuki-Thuo on +254722762698 or email, cwangeshi@gmail.com

Should you have concerns about the way in which the research has been conducted, you may contact Prof. S. Mokoena, Cell: +27 (82) 675 6155 Email: mokoesp@unisa.ac.za

Thank you for taking time to read this information sheet and for participating in this study.
Thank you.

Catherine Wangeci Kariuki-Thuo

CONSENT/ASSENT TO PARTICIPATE IN THIS STUDY (Return slip)

I, xxx, confirm that the person asking my consent to take part in this research has told me about the nature, procedure, potential benefits and anticipated inconvenience of participation.

I have read (or had explained to me) and understood the study as explained in the information sheet.
I have had sufficient opportunity to ask questions and am prepared to participate in the study.

I am aware that the findings of this study will be processed into a research report, journal publications and/or conference proceedings, but that my participation will be kept confidential unless otherwise specified.

I agree to the recording of the Questionnaire and/or Interview

I have received a signed copy of the informed consent agreement.

Participant Name & Surname (please print)

xxxx_____

_____

Participant Signature Date

Researcher's Name & Surname CATHERINE WANGECI KARIUKI-THUO

_____

_____XXXX_____

Researcher's signature Date

APPENDIX 6: TEACHERS QUESTIONNAIRE

SECTION A: DEMOGRAPHIC DATA OF THE RESPONDENT

Name of county ………………………………………….

Gender:

Male   ( )

Female   ( )

Your highest education Level

Secondary 'O' level   ( )

Primary 1 certificate   ( )

Diploma in Education   ( )

Bachelor degree in Education   ( )

Other Specify……………………………………………

Which position do you hold in the school?

Class teacher   ( )

Computer teacher   ( )

Discipline committee member   ( )

Others (Specify)…………………

Have you participated in any ICT-related course sponsored by school/Ministry of Education?

Yes   ( )

No   ( )

How many years have you served with the school?

0–1 years   ( )

1–5 years   ( )

5–10 years   ( )

Over 10 years ( )

SECTION B 1: EXISTING TEACHERS' SUPPORT STRUCTURES FOR ICT IMPLEMNTATION IN SCHOOL

Please fill in the questionnaire on teachers' support structures for using ICT. Using a scale of 0–4, where: Zero (0) = Not at all; (1) = Rarely; (2) = Sometimes; (3) = Often; and (4) = Always, indicate by ticking the alternative that represents your opinion on each statement.

1		0 Not at all	1 Rarely	2 Sometimes	3 Often	4 Always
	Existing Teachers' Support Structures for ICT Implementation					
1.1.	Our school has written statements explaining the general use of ICT to support teachers in implementation					
1.2.	Our school has explicit documents explaining use of ICT specifically for teaching and learning to support teachers in implementation					
1.3.	Our school has adopted and unpack the MOE policy for ICT-integration in Education to support teachers in implementation					
1.4.	Our schools convene regular in-school workshops for teachers on effective use of ICT by subject clusters					
1.5.	Our school motivates teachers who use ICT by reinforcing their work in various ways					
1.6.	Our school has a designated teacher or teachers who champion ICT in Education to support the ICT implementation					

SECTION B 2: EFFECTIVENESS OF EXISTING TEACHERS' SUPPORT STRUCTURES FOR ICT IMPLEMNTATION IN SCHOOL

Please fill in the questionnaire on teachers' support for ICT teaching & learning process. Using a scale of 0–4, where: Zero (0) = Disagree Strongly; (1) = Disagree; (2) = Agree Moderately; (3) = Agree; and (4) = Agree Strongly, indicate by ticking the alternative that represents your opinion on each statement.

2	Effectiveness of Existing Teachers' Support Structures for implementation of ICT	0 Disagree	1 Disagree	2 Agree	3 Agree	4 Agree
2.1.	Availability of written statements explaining general and pedagogical use of ICT guarantees technical expertise in teachers for implementation and use of ICT.					
2.2.	Existing MOE policy on ICT integration that has been adopted and unpacked for teachers leads to readiness in use of ICT by teachers.					
2.3.	Convening regular in-school workshops for teachers on effective use of ICT, results in updated expertise on ICT teaching methodologies in the various subject areas.					
2.4.	Motivating teachers who use ICT by offering them incentives reinforces the use of ICT in schools and leads to effective implementation of ICT.					
2.5.	Establishing an ICT-in-Education department with designated teachers to champion ICT in the school will supports all other teachers with effective implementation of ICT.					

SECTION B 3: GAPS IN TEACHERS' SUPPORT STRUCTURE FOR ICT IN THE CLASSROOM AND THEIR EFFECTIVENESS

Please fill in the questionnaire on teachers' support structures for using ICT. Using a scale of 0–4, where: Zero (0) = Not at all; (1) = Rarely; (2) = Sometimes; (3) = Often; and (4) = Always, indicate by ticking the alternative that represents your opinion on each statement.

		0 Not at all	1 Rarely	2 Sometimes	3 Often	4 Always
3 (a)	Gaps in teachers' support for ICT in the classroom					
3.1	Our school invests in adequate instruction time for teachers' support in ICT needs					
3.2	Our school has adequate computers in the classrooms					
3.3	Our school motivates teachers to use ICT in classroom teaching					
3.4 3.5	Our school organizes proper training of teachers on ICT use in classrooms					
3.6	Our school has mission and vision for use of ICT in classroom teaching					
3.7	Our school ensures that computer breakdowns do not interrupt classroom teaching					
3 (b)	Effectiveness of this Teachers' Support for ICT in the classroom					
3.8	Investment in adequate instruction time for ICT needs has led to effective integration of ICT in teaching methodologies.					
3.9						

	Adequate computers in the classrooms have led technical expertise in teacher use of ICT.					
3.10	Motivation of teachers on use ICT in classroom teaching has led to psychological readiness in use of ICT by teachers.					
3.11	Organization of proper training of teachers on ICT use in led to integration of ICT in teaching					
3.12	Availability of mission and vision for ICT use in classroom teaching has led technical expertise in teacher use of ICT.					
3.13	Ensuring that computer breakdowns do not interrupt classroom teaching has led to psychological readiness in use of ICT by teachers.					

SECTION B 4: STRATEGIES FOR SUSTAINING TEACHER'S SKILLS AND INTEREST IN ICT

Please fill in the questionnaire mechanisms for sustaining teachers' interest and skills using ICT in teaching and learning process. Using a scale of 0–4, where: Zero (0) = Not at all, (1) = Rarely, (2) = Sometimes, (3) = Often, and (4) = Always, indicate by ticking the alternative that represents your opinion on each statement.

		0 Not at all	1 Rarely	2 Sometimes	3 Often	4 Always
4 (a)	Strategies for sustaining teachers' skills and interest in ICT					
4.1.	Our school has adequate and well trained teachers on ICT use					
4.2.	Our school has reliable sources of power to support ICT use in classroom teaching					
4.3.	Our teachers have positive attitudes towards ICT use in classroom teaching					
4.4.	Our school has sufficient number of computers to support ICT integration					
4.5.	Our teachers have satisfaction with the introduction of ICTs in curriculum					
4.6.	Our teachers' have confidence in ICT integration in classroom teaching					
4.7.	Our school has teachers with adequate computer literacy among teachers					
4.8.	Our school has adequate subject teachers with training on how to integrate ICT into specific learning areas					
4.9.	Our school has tuned ICT-enhanced learning environments with the curriculum					

4 (b)	Effectiveness of these Strategies for sustaining teachers' interest and skills for implementation of ICT					
4.10	Adequacy of well trained teachers on ICT use has led to integration of ICT in teaching methodologies					
4.11	Reliability of sources of power to support ICT use in classroom teaching has led technical expertise in teacher use of ICT					
4.12	Teachers' positive attitudes towards ICT use in classroom teaching have led to psychological readiness in use of ICT by teachers					
4.13	Sufficient number of computers to support ICT integration has led to integration of ICT in teaching methodologies					
4.14	Teachers' satisfaction with the introduction of ICTs in curriculum has led technical expertise in teacher use of ICT					
4.15	Teachers' confidence in ICT integration in classroom teaching has led to psychological readiness in use of ICT by teachers					
4.16	Availability of teachers with adequate computer literacy has led to integration of ICT in teaching methodologies					
4.17	Adequacy in subject teachers with training on ICT integration has led technical expertise in teacher use of ICT					
4.18	Tuned ICT-enhanced learning environment has led to psychological readiness in use of ICT by teachers					

APPENDIX 7: INTERVIEW SCHEDULE FOR HEAD-TEACHERS

How do you share the current support structures for ICT integration in your school?

How do you support ICT integration in your school?

How do you monitor and supervise ICT integration in your school?

How do you evaluate ICT integration in your school?

What is the role of the head-teachers in success of ICT integration in your school?

How do you support the effectiveness of the teachers in driving ICT integration in your school?

How do you identify areas of development of teachers for success of ICT integration in your school?

What is the role of the head-teachers in success of ICT integration in your school?

How do you support the effectiveness of the teachers in driving ICT integration in your school?

How do you identify areas of development of teachers for success of ICT integration in your school?

How do you motivate your teachers to sustain interest in ICT integration?

APPENDIX 8: DECLARATION OF PROFESSIONAL EDITING

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5 November 2021

Declaration of professional edit

INTERROGATING TEACHER SUPPORT STRUCTURES FOR EFFECTIVE IMPLEMENTATION OF ICT IN KENYA PRIMARY SCHOOLS
by
CATHERINE WANGECI KARIUKI-THUO

I declare that I have edited and proofread this thesis. My involvement was restricted to language usage and spelling, completeness and consistency and referencing style. I did no structural re-writing of the content.

I am qualified to have done such editing, being in possession of a Bachelor's degree with a major in English, having taught English to matriculation, and having a Certificate in Copy Editing from the University of Cape Town. I have edited more than 300 Masters and Doctoral theses, as well as articles, books and reports.

As the copy editor, I am not responsible for detecting, or removing, passages in the document that closely resemble other texts and could thus be viewed as plagiarism. I am not accountable for any changes made to this document by the author or any other party subsequent to the date of this declaration.

Sincerely,

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