ANALYSIS OF WORLD VISION INFORMATION COMMUNICATION TECHNOLOGY PROJECT ON ACADEMIC PERFORMANCE OF PUBLIC PRIMARY SCHOOLS IN KENYA

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DECLARATION

This thesis is my original work and has not been presented for a degree in any other University.

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The undersigned certify that they have read and hereby recommend for acceptance of Masinde Muliro University of Science and Technology a thesis entitled, "The Effect of World Vision Information Communication Technology Project on Performance of Primary Schools in Kakamega County, Kenya".

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DEDICATION

To my family members, spouses Everlyne, Lutiguard and children.

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ABSTRACT

This study investigated the analysis of world vision ICT project on academic performance of primary schools in Matete Sub-County. The study objectives were: to establish the difference in academic performance of public primary schools with ICT infrastructure and those without between 2008 and 2016; to compare the difference in academic performance of public primary schools using ICT in teaching and learning and those which do not; to determine the relationship between ICT technical support and academic performance of public primary schools and to establish the relationship between teachers' perception and the use of ICT in Public primary schools. Descriptive Survey design was used to collect data.The study adapted quantitative research methods. The study targeted World Vision ICT project schools and those that did not get the support for comparison purposes. Purposive and random sampling techniques were used to identify key respondents. Structured questionnaires were used to collect data from head teachers and teachers. Reliability of research instruments was established through test-retest technique whereby reliability coefficient score of 0.72 for the head teachers and 0.78 for the teachers' questionnaires were appropriate since these indices were above the minimum recommended value of 0.7. The research experts helped to clarify the contents of the test items in the questionnaires. Data collected were analyzed inferentially using Stata. Results for objective one $t(10.1131)=3.0031$, $P=0.013$, indicated a statistically significant correlation between ICT infrastructure and the performance of primary schools. Therefore, the researcher recommended that MOEST should develop more ICT infrastructure in public primary schools. Findings on objective two (s41a4, P=0.043; s424a4, P=0.015) showed that there was a statistically significant correlation between ICT use and performance of primary schools, hence, the researcher recommended improved digital content including the use of local languages for effective interaction. The findings on the determination of the correlation between ICT technical support and academic performance of public primary schools, revealed statistically significant correlation, P= 0.022. Therefore, the researcher recommended that the government should deploy artisans with ICT management skills in all primary schools to repair and maintain both soft and hard wares. The results on objective four indicated Pearson Chi2 (1) = 5.2800, Pr = 0.022, Cramer's V= -0.3830. These results were statistically significant. On the basis of these results, it was recommended that teacher characteristics should be considered while assigning them duties and responsibilities.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

BEFA	Basic Education for All
EFA	Education for All
ICT	Information Communication Technology
KCPE	Kenya Certificate of Primary Education
MDGs	Millennium Development Goals
MOE	Ministry of Education
MOED - HRD	Ministry of Education, Human Resource Development
MOEST	Ministry of Education, Science and Technology
MMUST	Masinde Muliro University of Science and Technology
NCST	National Council of Science and Technology
NCTE	National Centre for Technology in Education
No.	Number
OECD	Organisation for Economic Cooperation and Development
QASO	Quality Assurance and Standards Officer
TSC	Teachers Service Commission
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNICEF	United Nations Children's Fund
WV-ICT	World Vision Information Communication Technology

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

In the current Knowledge based world, Information and Communication Technologies (ICTs) are major factors that shape the global economy and produce rapid changes in society (Wekesa, 2015). Globally, ICT tools have fundamentally changed the way people communicate and do business. They also have the potential to transform the nature of education, where and how learning take place and the roles of students and teachers in the teaching and learning processes. For education to reap the full benefits of ICT in learning, it is essential that teachers have basic ICT skills and competencies in order to model the new pedagogies and tools for learning (UNESCO, 2001).

The increasing permeation of ICT in all aspects of modern life has led to the concept of a "Knowledge-Based Society". The Technology Foresight Reports recommended that governments should establish a major fund to develop a centre for research in ICT and Biotechnology (Irish Council for Science Technology and Innovation, 1999). The increased investment in ICT will translate into generating and using new knowledge for economic and social progress within an innovation driven culture. In this case ICT will provide the ability to create, store and distribute knowledge more cheaply than ever in human history (Accenture, 2004). Kompf (2005), notes that the world of education has not been immune to the development of ICT. It is no longer possible nowadays to conceive of education without Information and Communications Technology (ICT). Education is increasingly being shaped by ICT.

Information Communication Technologies (ICTs) have brought about enormous changes globally. Access to technology, however, is highly unequal, thus digital divide between the information rich versus the information poor learners especially in public primary schools in Kakamega County. In spite of the vital importance of literacy in terms of its benefits for individuals, communities and nations, a vast number of learners remain illiterate. Despite the progress made over the past 60 years towards achieving universal literacy, the poorest and most marginalized groups of people have yet to be reached (Telecommunications Union- ITU, 2002). According to Wariga and Waema, (2005) ICT include internet service provision comprising of equipment and services which involve libraries, demonstration centres, commercial information providers and networks basic information services among other communication activities.

ICT has a direct role to play in education and if properly used it can bring many benefits to any learning scenario. Its functions give new opportunities for learner centred teaching approach. Greater opportunities for multiple information technologies delivered by teachers necessitate great enthusiasm for learning amongst the scholars (Sessional Paper No. 1 of 2005), in this case increased impetus in learning translate into improved academic achievement since the learners are able to access more information, hence, a wider range of learning experiences. Conway,(1997), asserts that supporting multiplicity of cognitive styles and learning behavior, unlike situations where content is presented to learners without the use of instructional materials, the modern forms of technology can be used to translate virtually any content into another media, making it more interesting and accessible to any kind of learners. SITE, (2002), observes that the brightest promise of

technology in education is to be used as a support for new, innovative, and creative form of teaching and learning. This entails using multimedia cases to teach topics that have previously been addressed through lecture method. The Kenyan Government has emphasized the Policy in Education through the policy document of the Kenya National ICT Master plan – Towards a digital Kenya (2014). Education is considered as a social pillar in Vision 2030 and her main goal under Education and training is to provide a globally competitive quality Education, training and research for development. The overall goal is to reduce illiteracy by increasing access to Education, improving transition rate from primary to secondary schools and raising the quality and relevance of education. This can be achieved through modernizing teacher training and strengthening partnerships with the private sector. One of the flagship Education and training projects is to establish a computer supply programme that is to equip learners with modern ICT skills (Mukwa, 2015). Through training, teachers acquire instructional skills using technology (Richard, and Howard, 1977). The skills are meant to analyze learning problems and device solutions using instructional technology.

Integrating into a curriculum different forms of technology and resources from the internet is valuable to a classroom teacher and learner. According to Robertson (1997), teachers are faced with myriad challenges in using technology. Many classrooms in the developing countries are ill-equipped to adopt the use of technology. In some areas, it is difficult to access telecommunication networks, yet these are essential for technology integration in instruction. He further asserts that many of the machines such as computers have short lifespan and must be replaced often. This has two drawbacks, that of cost implication and

the problem of disposing the old machines because they carry radio-active materials which are detrimental to human life. These challenges amongst others prompted World Vision to invest heavily in ICT infrastructure in Kakamega County under the programme of international collaboration towards illiteracy alleviation globally.

As technology has created change in all aspects of society, it is changing our expectations of what students must learn in order to function in the new world economy. Learners will have to learn to navigate through large amounts of information, to analyze and make decisions and to master new knowledge domains in an increasingly technological society. They will need to be lifelong learners, collaborating with others in accomplishing complex tasks, and effectively using different systems for representing and communicating knowledge to others (Dwyer, 1997). Above all ICT has brought profound changes to almost all aspects of human lives in the recent years. ICT skills have become as fundamental to living a full life as being able to read, write and compute, hence, the need for this study which is meant to address contemporary issues affecting the basic literacy levels amongst the learners in public primary schools.

The key objective of World Vision ICT Project was to improve the academic performance in the target study area with a view to transform the lives of the youth through the acquisition of Information Technology skills. The World Vision ICT Project was initiated in 2008 to address the challenge of underperformance in Matete Sub-County. At the start of this research study, the programme had lasted a period of 8 years. This duration was long enough to justify the need for an evaluation study like this one which was meant to ascertain the extent to which the project had achieved the set objective.

1.2 Statement of the Problem

In the current 21st century, Education determines livelihood and development intervention of individuals and Nations (Mukwa, 2015). However, the value of education is reflected in academic achievement of learners which is currently a global challenge. Kenya, a third world country on the African continent is currently experiencing low academic performance of public primary schools especially with the introduction of Government subsidized tuition in basic education offered by the government of Kenya from pre-primary to secondary education levels in all public institutions. Through research studies, it was noted by Uwezo- Kenya (2010), that Kakamega County experiences low literacy levels in primary school classes relative to the acquisition of reading, writing and arithmetic skills. Uwezo-Kenya tests were administered to assess literacy and numeracy levels among individual learners in kakamega County. The literacy test entailed letter sounds, reading a word, reading a paragraph and reading a short story. Numeracy tests involved number recognition, place value and performing basic operations of addition and subtraction. The findings revealed that less than one in three Grade 3 pupils passed any of the three tests. Specifically 29% of Grade 3 pupils passed the numeracy test, while 25% passed the literacy test. One out of six or 16% pupils passed both the numeracy and literacy tests. Uwezo- Kenya (2010) further established that only 20% of 3-8 year old children were able to tackle basic or real life mathematical problems and those 2 out of 3 learners in standard two were unable to read.

Many pupils in Kakamega County are not acquiring basic competencies as per the demands of primary school curriculum (Uwezo- Kenya, 2010). This could have been as a result of weaknesses in the management of the available instructional resources which the researcher believes should have built a stronger foundation for performance in upper primary classes. One of the global interventions intended to address the challenge of low academic performance in schools is through integration of ICT in educational curriculum. Effective implementation of ICT requires appropriate policy frameworks. In pursuit of this, the Kenya government developed an ICT Policy towards improvement of academic performance. In response to this, World Vision, an international humanitarian organization which partners with Kenya to improve educational performance in public learning institutions, developed an intervention strategy to boost the implementation of ICT policy framework in the teaching and learning processes amongst public primary schools in Kakamega County through the World Vision ICT Project (WV-ICT Project) as from the year 2008.

Public Primary schools in Kakamega County have consistently suffered the blow of performing dismally in Kenya Certificate of Primary Education (KCPE) examination. World Vision, which is one of the international Non-Governmental Organizations (NGOs) dealing with humanitarian issues, identified Kakamega County as one of the areas that deserved to benefit from education improvement project through Information Communication Technology (ICT). ICT-Policy framework was to guide in addressing the reduction of illiteracy levels especially in public primary schools. The project plan was to run from the year 2008 to 2016. Access to technology, however, is highly unequal, thus digital divide between the information rich versus the information poor learners. In spite of

the vital importance of literacy in terms of its benefits to individuals and communities in Kakamega County, a vast number of learners remain illiterate. Issues in ICT implementation policy have therefore necessitated an investigation on the effect of World Vision ICT project on academic performance of public primary schools in Kakamega County.

1.3 The Purpose of the study

The goal of World Vision ICT Project was to support the teaching fraternity to impart the necessary knowledge, skills and attitudes through the utilization of ICTs in public primary schools in Kakamega County. On the basis of this alignment the purpose of this study was to evaluate the effect of World Vision ICT Project on the academic performance of public primary schools in Kakamega County. More specifically, the study was to establish the correlation between World Vision ICT Project and the KCPE mean scores in Matete Sub-County, Kakamega County.

1.4.1 Objectives of the Study

i) To establish the difference in academic performance of public primary schools with ICT infrastructure and those without between 2008 and 2016 in Matete Sub-County.

ii) To compare the correlation in academic performance of public primary schools using ICTs in teaching and learning and those that did not, in Matete Sub-County.

iii) To determine the relationship between performance of public primary schools with and without ICT technical support in Matete Sub-County.

iv) To establish the relationship between teachers' perception and the use of ICTs in public primary schools in Matete Sub-County.

1.4.2 Hypotheses of the Study

i) There is no statistically significant difference in academic performance of public Primary schools with ICT infrastructure and those without.

ii) There is no statistically significant correlation in academic performance of public primary schools using ICTs in teaching and learning and those that do not.

iii) There is no statistically significant relationship between ICT technical support and academic performance of public primary schools.

iv) There is no statistically significant relationship between teachers' perception and the use of ICTs in public primary schools.

1.5 Scope of the Study

The study was conducted in Kakamega County, more specifically within target public primary schools which have benefited from the World Vision ICT Project in terms of setting up ICT hubs in comparison with public primary schools which were not covered by the project. The study focused on head teachers and regular teachers who were either trained in ICT or worked in school exam council because the head teachers were the overall managers of the school programmes, hence, had relevant information on how the WV-ICT Project was used by both the learners and the teachers in public primary schools. The regular teachers on the other hand were the actual curriculum implementers who had the role of overseeing how the learners were making use of ICT to learn and they also used ICT infrastructure in their day today instructional approaches as well as record keeping.

1.6 Justification of the Study

To change performance dynamics in educational institutions, there is need to employ innovative and niche approaches to educate and encourage people to solve problems in their community and enhance decision-making and communication skills. Good quality education can offer creative support and improved academic performance which can protect learners from psychological harm, exploitation and impoverished academic achievement. World Vision ICT project was meant to help in the improvement of academic Performance in public primary schools in Matete Sub-County using Information Technology (IT). This study was designed to interrogate the extent to which the project has impacted on students' academic achievement in order to draw relevant recommendations on how best to utilize Information Communication Technology(ICT) during the practical classroom activities in public learning institutions offering basic education in Matete Sub-County.

At the center of implementing the required education and make it of good quality lies the teacher. A teacher of the right training, attitude and mind set will perform his/her duties diligently to achieve the educational goals. Inversely, a teacher who is unsettled due to inadequate training especially in ICT related technical support and the general maintenance of software and digital content for teaching and learning, may not impart the right knowledge, attitude and skills to the learners. Equally, such a teacher may perpetuate irrelevant information in regard to the utilization of technology in the society. It is on the recognition of the importance of ICT use in passing the information to the learners that this study derived its strength.

Furthermore, owing to the multiple roles that Information Communication Technology (ICT) play in and out of school, there is every need to investigate the effect of World Vision ICT-Project as perceived by teachers and come up with informed knowledge on how to promote Information Technology through the teachers' activities in and out of school. Therefore, the findings of this study will be relevant to education managers, trainers, and policy makers in education, Educational management and policy studies in devising ways to transform teachers' perception on the utilization of ICT as they are engaged in their professional duties. Additionally, the findings will give information to teacher managers and employers on how best to manage educational content digitally. The findings will also be a source of information for teachers to act professionally as they dispense their duties innovatively and in a more child friendly learning environment.

1.7 Significance of the Study

Apart from this study contributing to the global volume of knowledge on the effect of World Vision ICT project on academic performance of public primary schools, the findings were geared towards the realization of measures that may help to resolve issues related to accessibility to information in order to reduce the digital divide amongst learners from basic educational institutions.

The findings may help policy makers to establish the extent to which existing policy on ICTs is working especially in public primary schools. Primary school teachers may acquire meaningful skills to enable them guide learners effectively on the prudent utilization of ICT as opposed to negative influences generated from illegal websites that enhance moral decay amongst the beginner learners. Above all, ICT has brought profound changes to

almost all aspects of human lives in the recent years. ICT skills have become as fundamental to living a full life as being able to read, write and compute, hence, the need for this research study which is meant to address contemporary issues affecting the basic literacy levels amongst the primary school learners. This will translate in the realization of one of the goals of Vision 2030 on IT compliance in Kenya.

1.8 Limitations to the Study

i) The research study was limited to Kakamega County because this was the County which had a successful World Vision ICT Project in public primary schools. However, the study findings may be generalized to other Counties which may have similar characteristics in Kenya.

ii) The qualitative analytical methods were not used since the study dwelt on hypothesis testing for all the four objectives which attracted the use of inferential test statistics.

iii) Limited availability of Kenyan and African literature in connection with the effective use of ICTs especially in public primary schools yielded a sparse research context. However, a review of literature borrowed from Western Countries provided adequate backdrop for this research study.

iv) The participants in the study were purposively sampled. Biases that could have emanated from this sampling method were overcome by the objectivity of data collection methods used by the researcher.

1.9 Theoretical Framework

The researcher adapted goal attainment theory by King (1971a). King's concepts focus on the methods to help nurses in the nurse-patient relationship. The theorist used a "systems" approach in the development of the dynamic interacting systems framework and subsequent Goal-Attainment Theory. In the theory, a general systems framework was developed and goal attainment. The framework refers to three interacting systems - individual or personal, group or interpersonal, and society or social, while, the theory of goal attainment pertains to the importance of interaction, perception, communication, transaction, self, role, stress, growth and development, time, and personal space. King emphasizes that both the nurse and the client bring important knowledge and information to the relationship and that they work together to achieve goals. The researcher relates King's concepts to a school, which is a social set up in which teachers interact with learners to set achievable targets. In this case, the World Vision initiated the ICT project with a view to support the education systems by supplying ICT infrastructure to public primary schools in Kakamega County. Teachers were to guide learners to interact with ICT soft and hard wares in order to enhance efficiency in learning to improve performance.

The relationship of three interacting systems which led to King's Theory of Goal Attainment are the personal system (individual), the interpersonal system (nurse-patient dialogue), and the social system (the family, the school, and the church). Each system is given different concepts. The concepts for the personal system are: perception, self, growth and development, body image, space, and time. These are fundamentals in understanding human being because this refers to how the nurse views and integrates self based from

personal goals and beliefs. Among all these concepts, the most important is perception, because it influences behavior. King summarized the connections among these concepts as "An individual Perception of self, of body image, of time, of space influences the way he or she responds to object and events in his/her life. As individuals grow and develop through their lifespan experiences, the changes in structure and functioning of their bodies over time, influence their perceptions of the self"(King, 1981, p.19). Personal systems are individuals, who are regarded as rational, sentient, social beings. These concepts informed the researcher to design an objective on utilization of ICT by individual learners within the school setting. The researcher was to assess the extent to which learners use the ICT hubs to access relevant information that was to be used to improve performance in public primary schools in Kakamega County.

The concepts associated for the interpersonal system are: interaction, communication, transaction, role, and stress. King refers to two individuals as dyads, three as triads and four or more individuals as small group or large group (King, 1981). This shows how the nurse interrelates with a co-worker or patient, particularly in a nurse-patient relationship. Communication between the nurse and the client can be verbal or nonverbal. Collaboration between the Dyads (nurse-patient) is very important for the attainment of the goal. This is quite critical in relation to the operations of a school. Teachers organize learners to work in groups and as they exchange ideas, they learn from each other. They are likely to retain the new knowledge in their memory longer. This is important because the learners will be part of the goal setting and work in consultation with the teachers to acquire knowledge and skills that improve their achievements in school related activities.

The final interacting system is the social system. This shows how the nurse interacts with co workers, superiors, subordinates and the client environment in general. These are groups of people within the community or society that share common goals, values and interests. It provides a framework for social interaction and relationships and establishes rules of behavior and courses of action (King, 1971). Social systems are organized boundary systems of social roles, behaviors, and practices developed to maintain values and the mechanisms to regulate the practices and roles. Among the three systems, the conceptual framework of Interpersonal system had the greatest influence on the development of her theory. She stated that "Although personal systems and social systems influence quality of care, the major elements in a theory of goal attainment are discovered in the interpersonal systems in which two people, who are usually strangers, come together in a health care organization to help and to be helped to maintain a state of health that permits functioning in roles" (King, 1981 p. 142).

Elements found in King's Goal Attainment Theory originated from the elements or concepts in Interacting Systems Framework. But it focuses on the Interpersonal System and the interactions, communications and transactions between two individuals, the nurse and the patient. The essence of the theory is that the nurse and the patient come together, communicate, and make transactions – they set goals and work to achieve the goals they set. They each have a purpose, they perceive, judge, act and react upon each other. At the end of their communication, a goal will be set and with this transactions are made.

King believed that the goal of nursing “is to help individuals maintain their health so they can function in their roles” (King, 1981), transactions occur to set goals related to the health of the patient. Furthermore, King proposed that through mutual goal setting and goal attainment, transactions result in enhanced growth and development for the client (Woods, 1994). King used ten major concepts from the personal and interpersonal systems to support the Theory of Goal Attainment. Those concepts include human interactions, perception, communication, role, stress, time, space, growth and development, and transactions. To capture the essence of these interrelated concepts, King stated that “nurse and client interactions are characterized by verbal and nonverbal communication, in which information is exchanged and interpreted; by transactions, in which values, needs, and wants of each member of the dyad are shared; by perceptions of nurse and client and the situation; by self in role of client and self in role of nurse; and by stressors influencing each person and the situation in time and space” (King, 1981, p. 144). Finally, according to the theory, nursing's focus is on the care of the patient, and its goal is the health care of patients and groups of patients.

The conceptual framework for the current investigation was derived from the concepts underpinning King’s conceptual framework and theory of goal attainment. The first part of the model shows that in the current investigation the learner is the central focus of the education system. Therefore, the personal, interpersonal and social systems should operate as whole to achieve maximum benefit for the learner. When all members of the conceptual system communicate, interact, transact and use critical thinking for decision making, they design an integrated learning process. If ICT skills are integrated in the learning process

and learners' focus on the use of ICT, there could be improvement in terms of quality service delivery, then, the perceived benefits of improved performance of public primary schools will be the outcome.

Nish, (2000), states that the benefits achieved from the use of ICTs include enhanced multidisciplinary collaboration, increased consistency in practice, increased coordination of learning activities, cost reduction, efficient and effective resource use, improved performance in academics, continuous quality improvement and ongoing review of practice and outcomes through variance tracking and variance analysis. These sentiments prompted the researcher to look into the value addition in primary curriculum through the use of ICT infrastructure created by world Vision ICT- project in Kakamega County.

1.10 Conceptual Framework

This study was guided by the following conceptual framework.

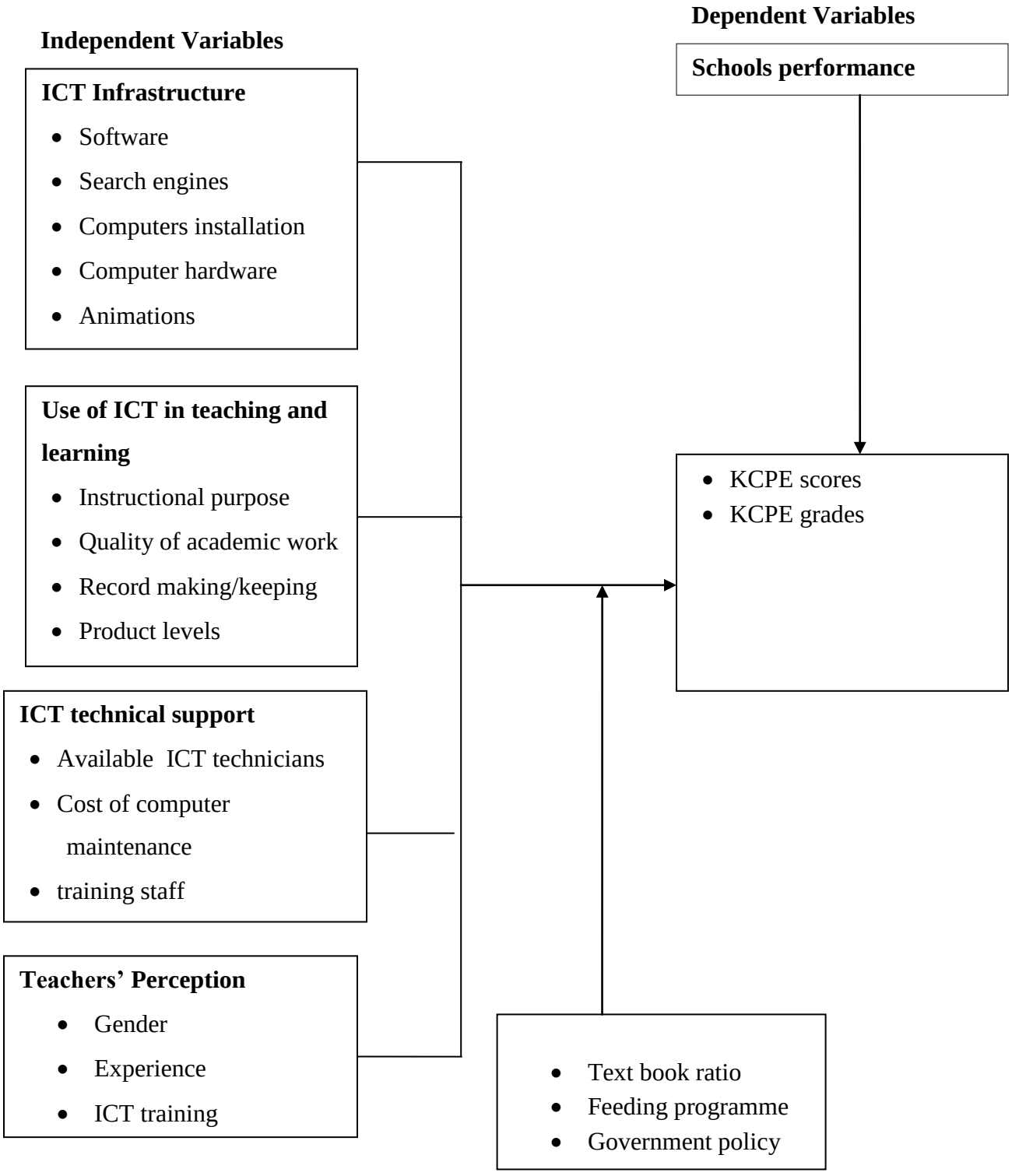

Figure 1: Conceptual Framework

Source: researcher's conception

During this study the researcher investigated how the Independent variables impacted on the dependent variable in the presence of moderating variables. In this case the researcher determined the degree of correlation between ICT investment through World Vision ICT-project and the academic performance of public primary schools in Kakamega County.

The investigation on the utilization of ICT infrastructure in teaching and learning was designed to establish whether those assigned to disseminate the ICT knowledge and skills understood their roles in the practical implementation of the digital curriculum content. A well trained teacher is expected to interpret the curriculum objectives and digital content well. This is to enable the teacher to offer quality services in the process of teaching and learning within public primary school set up. The training levels considered in this study was conducted by the World Vision personnel. The teacher training in ICT was further expected to impact on the general acquisition of the reading, writing and arithmetic skills among the primary school children. Despite the importance of ICT in regard to provision of basic Education, the training has generally been varied. To some extent many teachers have been given responsibilities of management of primary schools without training. In tandem with this study, the conceptual framework relates the independent variable; ICT infrastructure, ICT use in teaching /learning, ICT technical support, teachers' perceptionss and the academic performance of public primary schools in Kakamega County.

In the conceptualization of these variables the use of ICT was seen as an equalizer against the moderating variables: Textbook ratio and availability of feeding programme which play a role to improve academic achievement was held constant in the sampled public primary schools. A moderating variable is a third variable that affects the strength of the

relationship between the independent and dependent variable in data analysis. Examples of moderating variables in this study included the feeding programme and the ratio of text books against the number of learners. Moderating variables are important in scientific analysis like this one where the researcher wanted to determine the correlation between two variables, thus, World Vision ICT project versus KCPE performance in public pimary schools in Kakamega County.

According to Hayes (2013), a moderating variable**,** also called a moderator variable changes the strength or direction of an effect between two variables x and y. In other words, it affects the relationship between the independent variable and a dependent variable. In correlation studies like this one, the moderating variable is defined as a third variable - z - that affects the correlation between two variables x and y. A statistically significant moderating variable can amplify or weaken the correlation between x and y.

1.11 Definition of Operational terms

Innovation: Technological talents and entrepreneurship in educational sector

Hub: Digital laboratory including internet connection and search engines

Digital content: Educational content in software form

ICT-infrastructure: Items used in a computer hub including tools and Wifi services

Teacher development: Further training in information technology skills

Supplementation: Programmes for continued practice in utilization of ICT out of school

Lesson instruction: Teaching and preparing students to learn through technology

Software: Adequate computers and legal copies of digital instructional resources

Test runs and back up plans: Provision of sufficient time for practicing with equipment before students begin using them

Teacher motivation: willingness of teachers to use ICTs in lesson delivery

Educational technology: Theoretical development research and implementation of instructional process using ICTs

Teachers' perceptions: Aspects or qualities such as gender, educational level, experience and training in ICT.

IT Information Technology

ICT Information Communication Technology

UNESCO United Nations Educational Scientific and Cultural Organization

WHO World Health Organization

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The specific objectives of this study guided the researcher in reviewing the related literature. They included: to establish the difference in academic performance of public primary schools with ICT infrastructure and those without between 2008 and 2016 in Kakamega County; to compare the correlation in academic performance of public primary schools using ICTs in teaching and learning and those which do not in Kakamega County; to determine the correlation between performance of public primary schools with and without ICT technical support in Kakamega County; and, to establish the relationship between teachers' perception and the use of ICTs in Kakamega County.

2.2 ICT Infrastructure and Performance of Public Primary Schools

Global investment in ICTs to improve teaching and learning in schools have been initiated by many governments. In the United Kingdom (UK), the government spent £2.5 billion on Educational ICT in 2008-2009; in the united states, the expenditure on K-12 schools and higher Education Institutions was $6 billion and $4.7 billion respectively in 2008 and 2009 (Nut, 2010) while in New Zealand, the government spends over $410 million every year on schools' ICT infrastructure (Johnson, Hedditch & Yin, 2011). On the contrary the Kenyan budgetary allocation defined is indefinite in terms of actual expenditure towards improvement of ICT infrastructure in practical perspective especially among the public primary schools. All the investments on ICT infrastructure, equipment, and professional development meant to improve education should be adopted by all governments worldwide.

Gulbahar & Guven (2008) observe that schools have to be equipped with necessary ICT-infrastructure in order to provide the next generations with the needed tools and resources for access and use in order to attain the expected technological skills. On the other hand, schools are equipped with different kinds of technological infrastructure and electronic devices, software, hardware and networks to enhance the integration of ICTs in educational processes (Afshari, 2009). Limited access to ICT-infrastructure is a stumbling block to effective utilization of technology during the process of curriculum implementation. Availability of software and hardware enhances efficient use of technology. The gap between the use of traditional teaching and learning approaches and the modern methods that embrace the integration of ICTs, calls for heavy investment in technological infrastructure in order to convert print-based subject content into digital media. The underlying objective of ICT integration in schools is to facilitate and promote a learning environment that takes full advantage of technology in teaching and learning and encourages students to become self assured, self directed, which they will value throughout their lifetime (Mukwa, 2015). It is axiomatic that the provision of computer hardware & other up to date technology equipment is a priority area for investment.

Information Communication Technology (ICT) investments in educational institutions have been one of the key priorities of education policy during the last decade. Despite the attention, research on the effectiveness and efficiency of ICT is inclusive. This is because of small scale research with weak identification strategies which lack proper control group. Using the 2011 trends in international mathematics and science study data, control group is defined by matching similar characteristics of students, teachers and school's environment.

Results of this study indicated that accounting or not accounting for these characteristics may considerably alter the estimated impact of ICT in learners' performance especially in public primary schools. This suggests that a correction for the characteristics related to the students' population, teaching staff, administrative personnel and school management is warranted in the evaluation of the impact of ICT in the general performance of primary school learners.

ICT infrastructure investments in primary schools have an ongoing trend in many countries. Considerable amounts of public resources have been spent to acquire ICT gadgets the like of desktops, white boards, connectivity, software, laptops, and tablets among others. For example in Netherlands, large amounts of public resources have been invested in the implementation of ICT in Primary and Secondary Schools (Haelermans and De Witte, 2012).

A policy document published in 2008 for the parliament, the education council recognised that as a result of heavy investments, schools have acquired computers, internet connection and educational software at their disposal (Onderwjsraad, 2008); with the enormous amounts of public resources being invested in educational technology, a pertinent question is whether this investment has paid off in terms of higher efficiency and effectiveness in the entire school management practices, teaching and learning thus leading to improved performance in various activities being undertaken especially in public primary schools. In Netherlands, more pricey policy makers and stakeholders pose the same questions given the fact that they fail to understand how much school management and administration are

making use of the available resources to perfect on the general academic performance of primary school learners. This is because in case ICT policy is well implemented, the ICT infrastructure in the daily organisation, the integration of ICT in teaching and above all, whether or not ICT has positively impacted on learner's academic achievement (European School net, 2006).

Effectiveness denotes the extent to which ICT can improve education outcomes while efficiency refers to the extent to which ICT can replace traditional instruction methods. ICT benefit efficiency and effectiveness of daily activities in a learning institution, in this case schools use ICT infrastructure such as internet and digital learning environment to support administrative personnel in performing tasks such as financial management and daily organisation of school programmes. Teachers use ICT applications to collect learners' test scores, monitor progress of learners' achievements, report pupils' educational outcomes to the parents, and share information among the teaching staff.

Between 2003 and 2011 the Dutch noted that an increase of teachers' use of ICT infrastructure i.e. the use of computers in half of their lessons largely depended on the availability of ICT gadgets. Most countries differ in the way they utilise the positive trend in ICT usage due to the fact that the ICT infrastructure is insufficient. Some researchers advocate for the use of ICT in teaching and learning. This is in response to a positive impact of ICT on teaching and learning which improves educational outcomes of learners and reduces educational costs in the long run. This approach enhances flexibility and autonomy for pupils in their learning attitudes and experiences. All the same other scholars

hold a different view over the utilisation of ICT infrastructure to improve pupils' educational achievement. These scholars believe that the use of ICT in teaching and learning in terms of increasing pupils' academic achievement is not significantly positive. They observe that continued use of ICT infrastructure in teaching and learning may negatively impact on their performance since ICT tools may become distracters to pupils and teachers not having the necessary skills to use computers effectively in their teaching and learning processes (Braak, 2001).

The National Centre for Technology in Education (NCTE) established in 1998 with a brief to implement the schools IT 2000 policy was to zero down to provide ICT policy advice. The schools IT 2000 initiative was to oversee the technology integration initiative. The technology integration initiative was designed to support schools in developing ICT infrastructure with an aim of having at least 60,000 computers in schools by the end of year 2001 in Ireland. The schools integration project dealt with whole school development and investigated a range of teaching and learning topics with regard to ICT integration as a resource for teachers and learners in terms of appropriateness for use in classrooms. This is quite critical in that primary school learners deserve content that is relevant to the existing syllabus in line with the national as well as international goals of education.

A report by OECD (2001) noted that an average employment growth in the ICT industry has increased by 4.3% annually. This was showing a positive measure of transition from school to job creation World. Further studies by OECD (2006) observed that there was more drastic indicator of growth in ICT with a broadband benefaction of 3.3%. Such

findings provide irrefutable proof of the extent to which ICT is becoming increasingly essential for effective participation in social and economic world. Studies have shown that countries in the European Union covered by OECD have experienced tremendous growth on the impact of ICT on business and society generally improved on adoption of ICT and capitalising on its potential to develop economically. For example in 2003, Ireland was the leading exporter of computer software, hence, generating improved economic status.

By the year 2013, Ireland was renowned internationally as a nation with excellent research findings on ICT, hence, being on the forefront in generating and using new knowledge for economic and social progress, within an innovative driven culture. The critical sector underpins and enables the transition to knowledge based economy in the ICT sector which provides the ability to create, store and distribute knowledge more cheaply than ever in human history. The ICT sector essentially enables the existence and growth of the knowledge based economy (Accenture, 2004).

According to Kompf (2005) each author assumes ICT as a permanent feature in the landscape of teaching and learning. It is no longer possible nowadays to conceive education without ICT, thus ICT helps to demystify the definition of education globally. While funding for research has increased in recent years, the expert group on future ICT skills requirement continues to warn of shortfalls in the output of graduates in ICT. This implies that ICT graduates transiting various levels in the socio-economic world have inadequate IT skills to enable them compete favourably in the knowledge based world. Though ICT is a vital sector of the economy, requiring highly skilled professionals, it

represents only a relatively small fraction of the total employment. However, in the knowledge based economy as it is now and more so as it will be in the near future, ICT competence is a prerequisite for employees in virtually every area. Furthermore, the need for a facility with ICT is not confined to the work environment, but increasingly permeates all aspects of everyday life including all chores to be undertaken by an individual in any form of social context.

The social imperative for promoting ICT in public primary schools therefore is justified if pupils are to be prepared to lead a productive and fulfilled livelihood in a knowledge based society, they should be ICT competent on departure from the school system. This is in line with the recommendation by the Information Society Commission (ISC) in 2002 which recommended that basic ICT skills should as fast as possible become a core component of mainstream education.

According to BECTA (2003), the main approach used to evaluate the impact of technology on teaching and learning in public primary schools has been where pupils attainment across a range of tested curriculum outcomes has been correlated with the quantity and quality of technology which was available or which they experienced in their institutions. The successful gain translates into higher transition rate to the next level of schooling.

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an earlier teacher training agency study (Moseley *et al* 1999) though the interpretation by researchers was that more effective teachers, tended to use more innovative approaches or chose to use ICT resources that they had more appropriately, rather than that the technology itself was the cause of the differences in pupil performance. The connection between technology and learning is fairly consistent and other studies have indicated a stronger association. The ICT test bed evaluation identified a link between high levels of ICT use and improved school performance whereby the rate of improvement was faster in ICT Test Bed local Authorities than in equivalent comparator local Authorities in KS2 English (Somekh *et al* 2007). The causal link could be the reverse, with high performing schools more likely to have better equipment or more prepared to invest in technology.

OECD (2006) in a detailed analysis of the programme for international student Assessment data indicates a complex picture of association between pupil performances, their access to computers at home and at school together with frequency of use which varies from one country to another. Overally, the analysis suggests that the linkage may neither be a simple causal one nor necessarily a simple linear association, hence, there may be a limit to the amount of technology which is beneficial to the learners. As schools and teachers introduce technology they stop doing something else and when teachers choose to adopt technology themselves, they often do it as part of a process of inquiry (Somekh, 2007) and it replaces or displaces some problematic practice; in this case where technology is adopted for its own sake, it displaces or replaces other instructional approaches as well as the entire learning process. The integration of ICT should aim to replace less effective practices, and be effectively used alongside the other resources available to support pupils learning (Lucklin 2008).

Mabry and Snow (2006) note that one feature of the international research which is not reflected in my studies, is the role of ICT and digital technologies in assessment. A considerable proportion of the published research works, looks at computer based testing and computer adaptive testing. Pedagogical skills curriculum coverage and assessment are interlinked. The challenge will be to link work on pupils' involvement in formative assessment with effective diagnostic feedback for teachers. The assessment will provide a basis for the teachers to judge and make sound resolution either to allow a learner to transit to a higher level of learning or to classify individual learners in terms of ability to attain the set learning targets in a school or any other social organization.

Studies conducted by Kulik and Kulik (1991) analysed results from respondents on the question as to whether ICT usage results to better educational outcomes amongst learners of all age levels. It is noted that computer based instruction usually impacts the pupils outcomes positively with computer based teaching raising pupils' examination scores significantly. Moreover, it helps pupils in acquiring a more in depth understanding of subject material, challenge pupils' thinking and understanding and improves their problem solving skills.

Cox *et al* (2003) found evidence of a statistically significant and positive impact of ICT on pupil attainment in a lot of academic subjects. The evidence of a positive effect of ICT on the pupils' attainments appeared to be particularly robust in core subjects in the curriculum for instance Mathematics, Science and languages. The same study observed that some subject areas were poorly done. This signified the fact that ICT usage does not impact consistently on positive attainment by pupils in all curriculum subject areas. Cox et al

(2003) concluded that available evidence is much less consistent with the results depending on the subject area and the technological instrument being investigated. Nevertheless, they emphasised that a crucial factor is the manner in which ICT is applied by the teachers. Thus, the impact of ICT in pupil attainment depends to a considerable extent on which technologies are selected for use and on how they are deployed in the classroom.

A study by Cuban and Kirkpatrick (1998) and by Becta (2007) realised mixed results and concluded that there is no tangible evidence on the effectiveness of ICT in academic achievement. These findings contradicts to Cheung and Slavin (2013) who noted that ICT applications produce modest but positive impacts on mathematical achievements in comparison to traditional instructional methods.

Seo and Woo (2010) found the effects of computer assisted instruction programme that is developed to remediate specified mathematical skills amongst learners with special needs. They found that the computer assisted instruction programme may be an effective tool for helping pupils with learning disabilities, mastering specific concepts easily. These finding are in tandem with the results of a study by Serin (2011), Furkan and Kutluca (2012) and Garcia and Pacheco (2013), which confirms the effectiveness of ICT in promoting pupils' attainment in mathematics and science subject areas.

ICT may improve efficiency of educational process. Becta (2001) asserts that educational institutions use intranets to perfect their management and organisation of teaching and learning processes. This entails potential application of ICT in reporting of the

development of pupils in tests and assignments and monitoring pupils' performance and also sharing of information among the teaching staff members Selwood and Pilkington (2005) and the study by Price Waterhouse Cooper (2004) approved the fact that ICT enhances improved administrative and teaching processes among the educational personnel. In both studies, the findings suggested that ICT applications help to address workload issues within educational institutions. This is achieved through improved communication with learners, parents and other relevant stakeholders within the local community.

For a nation to achieve enviable economic performance and growth and to participate in the new knowledge based society, substantive and strategic ICT investment in schools is required. Adequate funding will allow schools to re-engage with ICT and to make significant progress towards ICT integration and the use of digital technologies and tools. Studies have revealed that Ireland for example, spent approximately 337 million towards ICT related equipment. This is a substantial investment and will have a significant impact. However, given the numbers of schools and students and the existing levels of ICT, the strategy group regards it as inadequate to fund progress beyond an acceptable baseline of ICT provision (DES, 2008).

The researcher observed that there was a policy framework on ICT in Kenya that recognises the range of ICT infrastructure that have been used in the delivery of education to improve access, teaching learning and administration to include; Electric Board, Audio Cassette, Radio for interactive Radio instructions, video learning, computer, internet and ICT support applications systems (SAS). However, the major challenge in respect to these components is limited digital equipment at virtually all levels of education. While the

average access rate is one computer to 15 (fifteen) students in most of the developed countries, the access rate in Kenya is about zero and this is because there is no documented evidence especially from public primary schools from Kakamega County. In addition it was noted through the Education Policy Framework (EPF) that in Kenya there are other challenges concerning access and use of ICT which include hindering students to access ICT facilities, limited rural electrification and frequent power disruptions among others. However, the policy framework planned to give attention to the use of ICT to expand access and equity in the delivery of Education services and curricula. It was from this understanding that the researcher coined the objective to establish the correlation between ICT infrastructure and the performance of public primary schools in Kakamega County.

2.3 The Use of ICT in Teaching and Learning Processes

Global investment in ICT to improve teaching and learning in schools have been initiated by many governments. For example Jordan as a resource, poor country seeks to build a strong ICT sector hub. In terms of integrating ICT in education, Jordan Ministry of Education in conjunction with the support of the Canada International Development Agency (CIDA) has developed a comprehensive e-learning strategy. This strategy aims to provide teachers' training project coordination, implementation and technical assistance such as equipping schools with computers in ratio of one (1) computer to every six (6) students have at the end an estimated number of one hundred and forty thousand (140,000) computers to be installed in all public schools (Al-zaidiyeen, Mei & Fook, 2010).

According to Baver and Kenton (2005) teachers who are highly educated and skilled with technology were innovative and adapt at overcoming obstacles but they did not integrate technology on a consistent basis both as a teaching and learning tool. Results indicated that schools have not yet achieved true technology integration. Furthermore, Gulbahar (2007) reported lack of guidelines that would lead to successful integration of ICT in classroom instruction creatively.

Numerous studies have been conducted to identify factors facilitating or prohibiting technology integration in the classroom more so the use of computers. Some researchers focused on the availability of computers in classrooms as one of the many factors influencing the utilization of ICT in the process of teaching and learning. A study by Becker and Ravita (2001) showed that computer use among teachers is related to constructivist views and practices and to chances in practice in a more constructivist – compatible direction. Other researchers suggest that there is a relationship between a teacher's child centred beliefs about instruction and the nature of teacher's technology – integrated experiences (Tottr *et al* 2006). A study by Chanlin, Anderson and Maninger (2007) investigated the changes in and factors related to learners perceived abilities, beliefs and intentions. Statistically significant changes were found in students' perceived abilities, self efficacy beliefs and intentions to use ICT in their classrooms. Abilities were correlated with self efficacy and computer access.

Flores (2002) observes that teachers face a myriad barrier in their quest to incorporate technology in classroom instruction. In addition to time scheduling for technology use and administrative support, equity is another important issue. The introduction of ICT use in

public schools is particularly hampered by inadequacy of resources. Eagle (2002) pointed out some barriers to the integration of technology in the classroom inclusive of both restraining forces that are extrinsic to teachers the like of access, time, support, resources, training and those that are intrinsic forces such as attitude, beliefs, practices and resistance. Brinkerhof (2006) further notes that barriers are grouped into four main categories namely resources, institutional, administrative support, training and experience or personality factors.

According to ITG (2012), a number of comprehensive tools and learning resources are provided in Eduwave to help students track their progress, improve their performance and enjoy their learning experiences. With Eduwave, learners can access their learning materials, the like of textbooks, personalised and in rich media format, from any computer, anytime and anywhere. Students can interact with their teachers and with each other through multiple communication and collaboration tools. For teachers, the administrative and educational tools provided on Eduwave, help teachers to better manage and utilize their time allowing for higher efficiency and more room for innovation and creativity. Eduwave provides an extensive collection of instructional design, authority and professional development tools and resources to support the role of educators. In addition to the ability to manage learning content and curricula, teachers can easily create their own teaching material. They are also able to interact with students through the systems various communication channels. Teachers are also provided with a variety of assessment and evaluation tools that help them measure individual student performance and progress (ITG, 2012).

Abuhmaid, (2011) notes that ICT is increasingly having pervasive role and presence in the educational milieu as it continues to shape all aspects of human lives. Teachers are widely believed to be the key agents of any educational change. Globalisation and the knowledge based economy have forced education systems worldwide to adopt ICT and weave it into their educational Millieus (Gulbahar & Guven, 2008). The system has adopted several ICT related education initiatives and implemented by education systems with greater appreciation of their complexity involving technological side which include access to computers, technical support and the e-materials (Abuhmaid, 2010).

In general, there is a high demand on educational institutions to use ICT to teach the skills and knowledge students need for the 21st century. There is need for every educational institution to restructure their educational curricula and classroom facilities to realise the effect of using ICT in their workplace in order to bridge the existing technology gap in teaching and learning (Baubeng, 2012). This restructuring process requires effective adoption of technologies into existing environment in order to provide learners with knowledge of specific subject areas to promote meaningful learning and enhance professional productivity (Tomec, 2005).

E-learning technologies are progressively fostering the means used to deliver and share knowledge. They play a key role in modernising the educational system by overcoming the limitation of distance and time required to access and deliver knowledge. The essence of using e-learning equipment in education is tremendous. They can provide immediate access to information, increase the speed of locating and retrieving information; in addition

the use of internet in education can provide learners with continuously updated information as well as student – teacher online interaction (Assaf *et al*, 2007)

Looking at the literature available, the researcher noted with concern the pertinent role that ICT play in relation to the academic performance in schools. The knowledge gap was identified when the researcher realized the fact that most of the literature emanated from the Western Countries. None of the citation came from a Kenyan context especially from the public primary school perspective. This triggered the researcher to formulate an objective "to compare the academic performance of public primary schools that make use of ICT in teaching and learning processes against those which did not between the years 2008 and 2016 in Kakamega County."

2.4 ICT Technical Support and Academic Performance

According to UNESCO (2008), teachers need to be prepared to empower the learners through the utilization of technology. They are responsible for establishing classroom environment and preparing learning opportunities that facilitate the use of technology to learn and communicate. Most teacher training education put more emphasis on basic computer operations as opposed to involvement of advanced technical skills and specific content pedagogical applications (Tin, 2002). This has resulted to a wide gap in the manipulative skills geared towards improved utilization of ICTs in basic education. This has necessitated the design of the objective 'to determine the relationship between ICT technical support and academic achievement in public primary schools in Kakamega County,' with a view to unravel the extent to which ICT technical support is affecting the use of technology in the teaching and learning processes. The technical knowledge and

skills are expected to assist in reducing anxieties associated with the use of technology by teachers in public primary schools. Technical experts are hired to address the need for expertise skills in the maintenance aspects of ICTs. It is assumed that shortage or lack of technological experts may negatively impact on academic performance since the tear and ware and the general maintenance services of the software and hardware in order to ensure sufficient service delivery within educational institutions (Tin, 2002).

Jordan seeks to build a strong ICT sector to realise its vision of being a regional ICT hub. In the near past few years Jordan has been working extensively both with local and external organisations to modernises her ICT infrastructure, promote ICT awareness and alleviate business climate to attract more local and foreign direct investments in the ICT sector (Assaf, Elia, Fayyoumi & Taurino, 2007). It is along this evidence that the researcher seeks to establish and document the extent to which the republic of Kenya collaborates with other stakeholders in developing structures meant to improve ICT infrastructure and more so assess the input realised for partnering projects with World Vision, a case of Matete Sub-County, Kakamega County, Kenya.

In terms of integrating ICT into education Jordan, the Ministry of ICT in conjunction with the Ministry of Education and the support of the Canadian International Development Agency (CIDA) have developed a comprehensive e-learning strategy. This strategy aims to provide teachers training, project coordination, implementation and technical assistance, such as equipping schools with computers in ratio of 1 computer to every six (6) students (1:6), to have at the end an estimated number of 140,000 computers to be installed in all public schools. Today all Jordan's 3500 public schools currently are connected to the

intranet (Al-Zaidiyeen, Mei, & Fook 2010). All these programmes are meant to enrich the teaching and learning environment to improve students' accessibility to information which synchronously transforms into improved academic performance.

Tomasegoric, Elias, Baracic and Mrvac (2011) noted that through e-learning, a new educational environment can be set and an environment can be constructed in the direction of interaction, processing information, researching and problem solving. Moreover, the findings of Tomasegovic *et al* (2011) revealed that e-learning provides direct students' involvement in planning and development of the class; enables students to learn and memorise up to 80% more information than they do when just reading or listening since e-learning includes video materials and lots of practical exercises and at the same time e-learning gives students an opportunity to make their own schedule of managing given assignments.

According to Qablan, Jaradat & Al-Momani (2010) Jordan, as a developing Country has witnessed an extensive educational reform movement since 1980. Jordan is attempting to develop ICT in an increasingly globalised world. Jordan as a nation has engaged in a number of initiatives to develop vigorous, export oriented ICT services that can enable her to become a regional leader and internationally recognised exporter of ICT products and services (Nusseir, 2001). More than a decade ago, the MoE of Jordan has cooperated with JEI to initiate the introduction of ICT and e-learning resources in classrooms to support innovative teaching practice (Light & Rockman, 2008). This has prompted the design of this specific objective: to determine the correlation in academic performance of public primary schools with and without technical support in Kakamega County.

In Jordan, public schools use the power of ICT with the proven methods of learning to transform the learning environment to be rated as better and conducive for interaction by learners. On the contrast Kenyan Public primary schools are yet to actualise the use of ICT infrastructure. The government of Kenya is still experimenting by suggesting to make use of tablets in standard one and the programme requires a lot of input to enable it stabilise, hence, the design of this study to evaluate and come up with practiced practises that can help the Kenyan government to achieve her dream on the efficiency in rolling out the one laptop per child project in the public primary schools. Government officials and stakeholders in education believe that integrating ICT in education reform will improve the Kenyan Education system and that ICT will impact positively on the general performance in the world of academics whereby students will be prepared to compete favourably on the international job market (Abuhmaid, 2011).

Brown (2004) who is one of the proponents of ICT believes that ICT integration into school curricula will necessitate improved academic results as well as the entire school functioning (Davis & Venezky, 2002). According to the proponents of ICT, the basis of improvement is founded on increasing the schools' ability to prepare learners and teachers for the technology and knowledge based society; increasing learners' access to educational data; supporting new pedagogical practices and improving classroom administration (Miller, Naidoo, & Van Belle, 2006).

Hermans, Tondeur, Van Braak and Valckle (2008) have identified three main stages for ICT to be valued and regarded by teachers; integration, enhancement and complementary. Integration approach is about implementing right use of ICT in particular subject area that involved complex concepts and skills to improve students' achievement and attainment. The review of curriculum is needed so that only related ICT resources and appropriate software will be installed for the main aims and objectives of curriculum to be achieved. Previously researchers established that the use of ICT in teaching will enhance the learning process and maximise students' abilities in active learning (Jamieson–Procter *et al* 2013). This approach allow students to be more organised and efficient in which they can obtain notes from computer, submit their work by e-mail from home as long as they meet the deadline and looking for information from various sources provided online to fulfil the task given to them (Hermans *et al*, 2008).

Technology based teaching and learning can make many changes in school that requires for proper planning and policy making. Researchers and policy makers must both have the same insight about the future plan. Dudeney, (2010) notes that National ICT policies can serve several functions which are critical in the current knowledge based economy. They provide a rationale, a set of goals and vision of how education systems run. If ICT is integrated into teaching and learning process and they are beneficial to students, teachers, parents and general population of a given country. It is along this argument that the design of this objective was viewed as pertinent in trying to establish the extent to which programmes offered to supplement the world vision ICT project are meeting the expectations of various stakeholders in the world of education in Kenya as well as globally.

The Ministry of Education, Malaysia has formulated three main policies for ICT in education. The first one insists on all students are given equal opportunity to use ICT. This policy framework is quite relevant to the Kenyan situation where all learners in public primary schools should be given an opportunity to adequately make use of ICT infrastructure for self development. This policy aims at reducing the digital gap amongst scholars. The second policy focuses on the role and functions played by ICT. Besides that, another policy stresses on the use of ICT for accessing information, communication and as productivity tool (Chan, 2002).

Infrastructure and facility of ICT is needed and should be supplied to all public schools. A key factor in the use of ICT is sufficient computer labs and ICT equipment. This ensures that subject teachers have easy access to ICT tools whenever needed (Hennessy, Ruthven, & Brindley, 2005). Inadequate ICT equipment and internet access is one of the key problems that schools have especially in rural set ups.

Many schools have computers but this could be limited to one computer in the office. Even in schools with computers, the students computer ration is high and some findings show that schools with ICT infrastructure are supported by parents or community power (Chapelle, 2011). This information explain the need to improve the ICT infrastructure across all public schools irrespective of location of the schools thus whether urban or rural set up.

Technical difficulties are a major factor in some schools causing a major problem and a source of frustration for students (Jamieson-Proctor *et al,* 2013). The effect is that teachers are not able to use computers temporarily and this may cause interruptions in the teaching and learning process. Turel and Johnson (2012) observe that technical problems become a major barrier for teachers. These problems include low connectivity, virus attack and malfunctioning printers. Schools in countries like Netherlands, U.K and Malta have recognised the importance of technical support to assist teachers to use ICT in the classroom (Yang & Wang, 2012)

Teachers' readiness and skills in using ICT play an essential role in the use of ICT to implement the technology and have high confident level to use it in classrooms; Besides, teachers need insight into pedagogical role of ICT, in order to use it meaningfully in their instructional process. Winzenried, Dalgarno and Tinker (2010) noted that teachers who have gone through ICT course are more effective in teaching by using technology tools as opposed to those that have no experience in such training. In Canada, some teachers admitted to be reluctant to use ICT because they worried they might get embarrassed that students know more about the technology than they did (Hennesly et al., 2005). This enhanced the researcher's impetus in finding out the training programmes available for teachers of ICT in Matete. Further training in IT will promote hands on skills in computer works, hence, promoting efficiency in the use of ICT skills by educational instructors.

A part from basic skills training, schools use a variety of strategies to provide further professional development for ICT teachers. Warwick and Kershner (2002) pointed out the significance and advantages of ICT to be clearly known by teachers in order to conduct a meaningful lesson with the use of ICT. Indeed, teachers should be exposed to further training courses to learn about integration of ICT in teaching and learning processes. Some schools use peer tutoring. This is where a more skilful teacher is used to assist and guide other teachers who are less experienced with ICT alongside the preparation work for teaching and learning.

In European school net (2010) survey on teachers' use of Acer notebooks involving six European Union countries, a large number of participants believed that the use of notebook had positive impact on their learning, promoted individualised learning and helped to lengthen study beyond school day. BECTA (2004) acknowledges this by noting that it is important for teachers to access ICT in order to plan, teach with it, and prepare lessons. Teachers who use ICT regularly are likely to be confident and have a positive attitude towards it, hence, perceiving ICT as useful tool. However, BECTA (2004) argues that factors affecting the use of ICT are complex and can only be interpreted in the context of which ICT is used. Therefore it is worth noting that contextual factors within which each country do have an influence on the extent which ICT is used. It is for this reason that the current study is meant to assess the current ICT programme in Matete and underlying factors influencing the use of ICT in academic programmes in primary schools.

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Harrison *et al* (2004), identified statistically significant findings positively associating higher levels of ICT use with school achievement at each stage English, Mathematics, Science, Modern foreign languages and design technology. An association between high ICT use and higher pupil attainment in primary schools was also reported in an earlier teacher training agency study (Moseley *et al*, 1999, p82) though the interpretation by researchers was that more effective teachers, tended to use more innovative approaches or chose to use ICT resources that they had more appropriately, rather than that the technology itself was the cause of the differences in pupil performance. The connection between technology and learning is fairly consistent and other studies have indicated a stronger association. The ICT test bed evaluation identified a link between high levels of

ICT use and improved school performance whereby the rate of improvement was faster in ICT Test Bed local Authorities than in equivalent comparator local Authorities in KS2 English (Somekh *et al*, 2007). The causal link could be the reverse, with high performing schools more likely to have better equipment or more prepared to invest in technology.

OECD (2006) in a detailed analysis of the programme for international student Assessment data indicates a complex picture of association between pupil performances, their access to computers at home and at school together with frequency of use which varies from one country to another. Overally, the analysis suggests that the linkage may neither be a simple causal one nor necessarily a simple linear association, hence, there may be a limit to the amount of technology which is beneficial to the learners. As schools and teachers introduce technology they stop doing something else and when teachers choose to adopt technology themselves, they often do it as part of a process of inquiry (Somekh, 2007) and it replaces or displaces some problematic practice; in this case where technology is adopted for its own sake, it displaces or replaces other instructional approaches as well as the entire learning process. The integration of ICT should aim to replace less effective practices, and be effectively used alongside the other resources available to support pupils learning (Lucklin, 2008).

Mabry and Snow (2006) note that one feature of the international research which is not reflected in many studies, is the role of ICT and digital technologies in assessment. A considerable proportion of the published research works, looks at computer based testing and computer adaptive testing. Pedagogical skills, curriculum coverage and assessment are

interlinked. The challenge will be to link work on pupils' involvement in formative assessment with effective diagnostic feedback for teachers. The assessment will provide a basis for the teachers to judge and make sound resolution either to allow a learner to transit to a higher level of learning or to classify individual learners in terms of ability to attain the set learning targets in a school or any other social organization. The gap exists where access to ICT technical support is limited amongst teachers due to inadequate technical training and fast growing ICTs which require regular short courses through in service or online training.

The National Centre for Technology in Education (NCTE) established in 1998 with a brief to implement the schools IT 2000 policy was to zero down to provide ICT policy advice. The schools IT 2000 initiative was to oversee the Technology Integration Initiative. The Technology Integration Initiative was designed to support schools in developing ICT infrastructure with an aim of having at least 60,000 computers in schools by the end of 2001 in Ireland. The researcher was determined to ascertain the extent to which public primary schools in Kakamega County embraced and engaged the use of ICT experts if any and evaluated the extent to which this variable impacted on KCPE performance. This was unique in that the available literature only outlined the role of ICT experts but did not specify the employer and more so none derived its source from the developing countries, more so, Kenya

2.5 Teachers' Perceptions and the Use of ICT in schools

Globalization and the knowledge based economy have forced education systems worldwide to adopt ICT and weave it into their educational Milieus (Gulbahar & Guven,

2008) and the Kenyan MOEST is no exception. In the 21st century, ICT related initiatives are adopted and implemented by education systems with great appreciation of their complexity. A major aspect of the complexity involved with ICT integration into educational system is based on the many factors involved thus relating to human involvement which entails teachers, trainers and administrators and on the other hand, the technological side involving access to computers, technical support and the e-materials (Abuhmaid, 2011). Generally, there is a growing need for educational institutions to use ICT to teach the skills and knowledge students require in order to thrive in the 21st century.

Educational technology has become a cornerstone for any country's efforts to improve learners' academic achievement. It has become the focus of educators worldwide. A study by the United Arab Emirates (2010) investigated technology integration in schools and established that there were an increasing number of computers and other technological devices available to schools. This is because technology allows students to learn more in less time and allows schools to focus on global learning environments if used appropriately (Wood & Askfied, 2008; Gulbarhar, 2007; Kenton, 2005, & Zhao 2007). According to Lam & Lawrence, (2002), Technology not only gives learners the opportunity to control their own learning process but also provides them with ready access to a vast amount of information over which the teachers have no control.

A survey based on a National Centre for Education Statistics (NCES, 2000) found that 39% of teachers indicated that they used computers or the internet to create instructional materials, 34% for administrative record keeping, less than 10% reported to access model

lesson plans or access research and best practices. Similarly a report released by the United States department of education indicated that novice teachers were more likely to use computers or the internet to accomplish a variety of teaching objectives (NCES, 2000). These findings contradict the feelings of experienced teachers who have taught for a period of more than 20 years. This is in line with the findings of Guha (2000) who reported that there are significant differences and positive correlations between teachers' perceptions, computer training, level of comfort and computer usage in the classroom out of prolonged exposure to technology.

Mukwa, (2015) notes that there are people in the society who feel that teaching and learning is already established and therefore there is no need to integrate technology in teaching. It should be integrated in fields like transport, agriculture and tourism. Other critics say that computers as a component of ICT pose potential health problems like poor eyesight, young people accessing pornographic materials among others. Teachers' slogan "laptops can wait, teachers cannot" is proof enough to depict the negative view on the use of ICT in schools in Kenya.

A study by Manzo (2001) found out that many students who are drawn from Electronic Arts class were struggling in most of their other classes. Once they discovered what they could do with technology, they began to appreciate the importance of excelling in all subjects. Similarly, Sherry *et al* (2001) notes that teachers should emphasise the use of meta-cognitive skills, application of skills and inquiry of learning as they infuse technology into their academic content areas.

According to Bauer and Kenton (2005) teachers, who are highly educated and skilled with technology are innovative and adopt overcoming obstacles, but they did not integrate technology consistently as a teaching and learning tool. Gulbahar (2001) observes that school administrators and teachers feel competent in using ICT available at school. The study further notes that there are inadequate policy guidelines that would lead to successful ICT integration in the teaching and learning processes.

Chanlin *et al* (2006) studied on factors affecting teachers' use of technology in creative teaching practices and discovered that environment, personal, social and curricula issues affect the process of teaching and learning in schools. Anderson (2007) discovered through research that significant changes relate to individuals' technology related abilities, self efficacy beliefs, value beliefs and intentions to use software in their future endeavours. In this study it was noted that learners' abilities correlate with self efficacy and IT access. This prompted the researcher to assess the extent to which these concepts were true in line with the actual teachers; perceptions in Matete Sub-County after the setting up of computer hubs in their territories by World Vision ICT project in 2008.

A study by Shashaani (1997) revealed that females were less interested in the use of computers and less confident than their male counterparts. The results also showed that males were more experienced. The findings further indicated that females improve their attitude towards computer use after training contrary to the findings by Hong and Koh (2002) who observed that female teachers were more anxious than male teachers towards hardware manipulation. In this study, the researcher will assess the level of involvement by both gender in order to draw relevant recommendations in favour of the learners of either sex.

Al-shboul, (2011) notes that teachers in K-12 public schools in Jordan manage their classes and use technology tools in their teaching. The results further indicates that Education wave e-learning system software tool is used by teachers to manage students enrolment, track students' academic achievement and create and distribute course content electronically. In Kenya this is not the case. Teachers literally apply manual skills in most curricula undertakings especially in public primary schools.

ICT is increasingly having pervasive role and presence in the educational Milieu as it continues to shape all aspects of human life. Numerous reform projects the like of World Vision ICT project in Matete, Kenya, have been in place with a view to infuse ICT across education system (Abuhmaid, 2011). Teachers are key agents of any educational change. In Jordan, the Ministry of Education spearhead the training programme in ICT courses with an aim of preparing teachers to integrate IT effectively across the curriculum. With a view to realize the effect of ICT on the workplace and everyday life, today's educational institutions right from basic to higher levels, should purpose to restructure their curriculum and classroom facilities in order to bridge the existing technology gap in teaching and learning (Bhabeng – Andoh, 2012). This restructuring process requires effective adoption of technologies into the existing learning environment in order to provide learners with knowledge, skills and attitudes of specific subject areas, to promote meaningful learning that will enhance improved performance (Tomei, 2009).

A study by Reid (2002) revealed teachers' concerns and problems as regards the use of technology in teaching. Results showed that while recognising that there are some concerns and problems in integrating the use of ICT in schools, teachers thought that it was

beneficial to the educational process and should be embraced. The study further unveiled and noted most often problems as the maintenance of the ICT equipment needed to operate a technologically enhanced school. Another frequently mentioned problem was the disparities between students who have access to the internet at home and those who do not (inequalities). Through the same study, teachers observed evidence of the importance of the efforts in schools to promote professional development in integrating information technology into classroom teaching. This calls for further and consistent teacher training in IT. Teachers further recognized that sometimes students are overwhelmed with amount of information available and with the task of filtering through the information. This means that learners are over-burdened with academic work which may make them to negate some important information, hence, poor performance.

Wheeler (2000) pointed out that teachers have stress in keeping up with the pace of the fast advancing changes in technology. Through this study, teachers noted increased plagiarism as a concern since technology was making it easy for students to reproduce and revise other people's work. These concerns prompt a niche approach in handling learners. This may as well encourage extended reading by teachers in order to match the much informed student fraternity. This will as well call for refined teaching approaches as opposed to out dated methodologies embraced by a cargoon of long serving teachers especially in public primary schools.

According to Rogers (2000) barriers to successful technology adoption in education have several sources ranging from teacher attitude, teachers' actual competency level with ICT, the availability and accessibility of the internet, presence of technical support, available time frame, while manipulating ICT gadgets, inadequate training programme for staff development among others. These are some of the upcoming challenges that require immediate and appropriate attention of the government and individual stakeholders in educational attributes.

Rogers (2003), identifies technological attributes that influence the decision to adopt an innovation of ICT in schools as relative advantage, compatibility, complexity, triability and observability. Balanskat, Blamire & Kefalla (2006) noted factors such as teacher level, school level and system level. Teachers' integration of ICT into teaching is also influenced by organisational factors, attitudes towards technology and other factors (Chen, 2008; Tondeur, Valcke, & Van Braak, 2008; Lim & Chai, 2008). Neyland (2011) observes that factors such as institutional support and teachers' capability influence the use of online learning. Schiller (2003) points out that personal characteristics such as educational level, age, gender, educational experience with the computer and attitude towards ICT can influence the adoption of technology.

Baubeng - Andoh (2012) further notes that personal attributes such as teacher's attitude, knowledge, ICT competence, computer self efficacy, gender, teaching experience, teacher workload, accessibility to IT, technical support leadership support training, existing values, past experiences and ease to utilize ICT and e-learning among others do affect the level of ICT adoption in public schools.

Technological progress combined with a parallel evolution of pedagogical sciences results in the belief that the integration of ICT into learning interaction may bring about a new era in the educational practice (European Commission, 2002; Tsikalaki & Valatidis, 2010). All the same, the introduction of ICT in the Educational practice is followed by a myriad of essential gaps and encounters multifold difficulties. This fact turns ICT into a significant challenge for both the needs and orientation of each and every educational system (Kynakou & Charalambous, 2006), imposing a complete review of their planning and organisation in order to make transition to a new stage of systematic exploitation of technology possible.

According to Mastros, (2010) the structural inflexibility of education system, the traditional assessment systems and the restrictive teaching materials, act as a resistance factor working against the introduction of innovations and the application of research results into classrooms. A significant number of reforms of the late years do not seem to have changed the existing pedagogical practices assimilating counterproductive and absolute school (MOE, 2010). More specifically, as far as ICT is concerned, it is pointed out that despite the repetitive attempts to introduce them into education system, innovation and qualitative teaching upgrade seem to remain "written on paper" as the teachers of ICT tend to use technology by just adapting to their own methods and practices (Liakopoulou, 2010; Tokmakidou *et al*, 2010). At the same time, the repetitive projection of pedagogic issues under a technical and practical perspective seems to lead to unfulfilled expectations, supporting a series of problems which due to their extent and complexity deter the clarification of the situation (Sionou-kyrgiou, 2010). The quantitative and qualitative under use of computer at school, the absolute and already problematic laboratory equipment and

the inadequate teacher training intensify even more the question around the issue of computer use (Shoretsanitou & Vekyri 2010; MOE 2010). Focusing on the expressions via the observation of a number of researchers, it is evident that the issues surrounding technological advancement in public primary schools are far from over. This crowns the design of this study meant to evaluate and come up with vivid resolutions to problems surrounding the successful adoption of computer knowledge in schools offering basic education through higher learning levels with a view of realizing the Kenyan vision 2030.

Teachers form the central pillar in constituting the 'New Digital School' through which the use of ICT effectively in the learning process is directly linked to the pursuit of educational reforms (Bikos & Tzifopoulos, 2011). The perception of teachers of ICT on the role of ICT in the implementation of effective teaching, the potential obstacles encountered during its use, possible participation in relevant training and the feeling of efficiency and effectiveness during the ICT supported teaching interaction; significantly affect the quality of educational practice (Gogoulos *et al* 2011). This argument ignites the researcher to assess the extent to which the trained teachers of ICT in Matete effectively utilize IT skills during curricula coverage especially in those public primary schools that benefited from the ICT project funded by the World Vision in collaboration with the Kenyan Government.

Papageorgakis *et al* (2011) observes that only one out of two teachers of ICT in Primary Education state that they feel adequately trained for their role. The generalised, vague curriculum and absence of a school book may have a negative effect of teachers of ICT feeling of self efficacy and the quality of their work in the classroom (Sang *et al* 2010; Vaggelatos *et al*, 2011). Increased usage of computers at school is insufficient to overcome

effectively the obstacles that ICT integration brings into the educational process. The result of this effort relies on relevant views and beliefs that teachers hold about the integration of ICT in their pedagogical approaches (Fessakis *et al* 2010).

Taking into consideration the MOEST's focus on a horizontal, integrated approach of ICT, in Education, while teachers of ICT are oriented towards techno centric or pragmatic approaches; expressing severe oppositions against many of the axes of the current education reform, it is evident that the implementation of the direction prescribed in the Ministry's notification is easy. As a result the delayed, forced and generally disorganised introduction of ICT in Education appears to be repeated, once more, confirming its problems and deadlocks (Tsimas, 2009; Liakapoulou, 2010). It is therefore important to include the contributions and develop critical thinking behind the ICT integration in the entire educational system in Kenya.

With the development of learning technologies in the late 20th century, education system has changed rapidly. This is due to the capability of technology to provide a proactive, easy access and comprehensive teaching and learning environment. The governments through their respective Ministry of education all over the world provide a lot of facilities and training in order to enhance the use of advanced technologies in the countries' teaching and learning process. A high budget has been placed in order to provide the equipment needed by teachers to improve the education system. Despite all the efforts, most of the countries are facing similar problems whereby teachers are not maximising the usage of the technology provided (Albirini, 2006). This is because many research works have proven the usage of ICT in teaching and learning process could improve students

achievement (Nakayima, 2011; Jamieson-Proctor *et al*, 2013). Zhang, (2013) and Dudeney (2010) observed that major barrier on the implementation of ICT was the teachers' belief as the teachers are the persons who implement the change in their teaching and learning process. Moreover, a study by Cassim and Obono (2011) shows that the correlation of teachers' belief and the use of ICT are high. Teachers' role is getting more important especially in the usage of ICT in pedagogy which could increase the achievement of the students in their creativity and thinking skills.

Teachers' computer experience correlates positively to the utilization of ICT. The more experience teachers have with IT, the more likely that they will show positive attitudes towards computers (Rozell & Gardner, 1999). Positive attitudes are expected to foster ICT integration in classroom situation. Most teachers use laptops for administrative tasks associated with their obligation for teaching. Specifically laptops are used for recording and checking students' grades as well as writing reports for parents. Laptops in this case were used to allow teachers to complete administrative tasks easily and efficiently.

According to a study by Unachukwu and Nwankwo (2012) on principals readiness to use ICT for schools administration, revealed that most principals shy away from computers claiming that the innovation is for the youngsters. Furthermore many principals were handicapped as far as the use of ICT is concerned. This resulted to poor staff and student management as well as dismal student attainment. Nwalongo (2011) agrees with Unachukwu and Nwankwo (2012) that teachers do not use ICT to bring change in their practices but rather sustain their traditions. On the contrary, the current study will make

use of questionnaires which will make the results to be more objective, hence, suitable for generalization. Secondly, this study is different from the available resources on ICT and the performance of learning institutions in that the kind of respondents used were new and also the location of the study was equally new. It was therefore necessary to conduct this study in order to enrich the development of informed policy guidelines from the local grass root level from the developing Countries.

2.6 The Feeding Programme and Performance of Schools

According to WHO, (2006) nutritional and health status are powerful influences on a child's learning and on how well a child performs in school. Children who lack certain nutrients in their diet particularly iron and iodine, or who suffer from protein-energy malnutrition, hunger, parasitic infections or other diseases, do not have the same potential for learning as healthy and well-nourished children. Weak health and poor nutrition among school-age children diminish their cognitive development either through physiological changes or by reducing their ability to participate in learning experiences or both. Contrary to conventional wisdom, nutritional status does not improve with age. The extra demands on school-age children (to perform chores, for example, or walk long distances to school) create a need for energy that is much greater than that of younger children. Indeed available data indicate high levels of protein-energy malnutrition and short-term hunger among school-age children. Moreover, deficiencies of critical nutrients such as iodine, vitamin-A and iron among the school aged are pervasive (Partnership for Child Development, 1998b).

According to World Food Programme(WFP) (1996) School Feeding Program (SFP) is essential to provide a balanced diet to children which would in turn enable the children to increase their attention span, hence, better academic performance. In this study it was hypothesized that school feeding program has an impact on the success of academic performance of public primary schools. The School Feeding Program is a crucial component in the development of a holistic child. Nutrition and health are powerful influences on a child's learning and how well a child achieves in school. The effect of poor feeding on young children can be devastating and enduring. In the area of brain development, when there is limited or no food at all, the body has to decide on how to invest the foodstuffs available. Survival comes first and other areas of child growth and development come next. Good nutrition attracts the consumption of a variety of food staffs in appropriate amounts, because there is no single kind of food that can provide all the necessary nutrients. The foods that provide protein, carbohydrates, fats, vitamins, minerals, and fibres are all very critical. Undernourished children have short attention span which is linked to low sugar levels. Food provides a good amount of glucose amongst children. Provision of balanced diet would enable children to develop their cognitive, psychomotor and affective domain. A healthy child will concentrate more in class work hence developing the cognitive part. The child can also play to develop physically and will interact with others with a lot of ease and grow in self esteem. In the year 2003 the Kenyan Government re-introduced Free Primary Education (FPE) to all public primary schools in Kenya aiming at boosting primary enrolment and retention of pupils in schools. SFP in public primary schools makes children to enjoy the learning at the centres since many of them come to school without breakfast. The researcher sought to establish the impact of

SFP and its relationship with academic performance among the primary school learners. The role of School Feeding Programme (SFP) is one of the several interventions that can address some of the nutrition and health as well as mental retardation related problems of school age children. School Feeding Programme (SFP) alleviate short-term hunger in malnourished or otherwise well-nourished school children, helping them increase attention span and producing gains in cognitive function and learning, addressing specific micronutrient deficiencies in school aged children. Meeting the iron and iodine needs of school-aged children can translate into better school performance (WHO, 2006). Increased community involvement in schools, particularly where programmes depend on the community to prepare and serve meals to children are more effective than schools with less community involvement. The study further noted that the number of hungry school-age children is unknown, but is likely to be a significant problem in various circumstances. Factors that contribute to hunger in school children include, the long distance children have to travel to school, cultural meal practices that include no or little breakfast or lack of family time or resources to provide adequate meals to children before or during the school day (WFP, 1996). Alleviating this hunger from school children helps them to perform better in school activities. The United States of America showed the benefits of providing breakfast to disadvantaged primary school students. Once in the program, however, test scores of the children participating in the program improved more than the scores of non-participating children. Furthermore, the attendance of participating children also improved (Meyers, 1989).

In Pakistan, a feeding programme provides an income in the form of one or two tins of oil to families whose girls attend school for twenty days per month. In its pilot phase the oil incentive program demonstrated that it could make a significant contribution to full attendance. In participating schools enrolment improved by 76% compared to14% for the non participating schools in the province overall. Attendance increased from 73% to 95% among participants. The program also claims to put additional food in the lands of mothers to serve as a contact between mothers and teachers on distribution days (WFP, 1996). In Bangladesh a program of school-based food distribution increased enrolment by 20% versus a 2% decline in no-participating schools (Ahmed and Billah, 1994). Micronutrient deficiencies of iron and iodine are among the most harmful types of malnutrition with regard to the cognitive development among the children. Iron deficiency renders children restless, inattentive and uninterested in learning. In South Africa, soup fortified with Iron and Vitamin C was provided to 350 schools in an area of six to seven year old and 20% of 8 to 12 years old children had low weight and 49% and 31% had low serum fertin which is a measure of Iron deficiency respectively. Breakfast programme in Peru, which included an iron –fortified ratio, was evaluated for its short-term impact on diet, amongst other factors. The program significantly increased dietary intakes of energy by 25%, protein by 28% and iron by 46% (Jacoby and Pollit, 1997). Makueni District in Kenya has been providing school lunches to every school with a lot of support from the World Food Program (WFP). Parents assist to provide some food stuffs; the aim was to ensure that children are not hungry, since, a hungry child cannot participate actively in the learning activities. Performance has been excellent which has been credited to a sustainable school feeding programme and this is in line with the observation made by Bimbo and Mwiria()

on the crucial role of nutrition in education. A number of interventions can promote the health and nutritional status of school children which may impact positively on the academic performance of primary school learners. Children come from diverse economic status therefore School feeding programme can bring about uniformity among children who might be vulnerable making learning effective and high rates of academic achievement by the learners in public primary schools. School Feeding Programs established in most areas are based on alleviation of hunger, this kind of program is seen to be necessary in Arid and Semi Arid Lands (ASAL) areas where, the supply of food is minimal and most schools depend on donors to provide food. Physical infrastructure and financial resources have been a challenge in the establishment of a successful school feeding programme in Kakamega County. Undernourished children consume little energy and other essential nutrients whereas over nourished children become over weight leading to health problems and social stress (UNESCO, 2007). This would impact on the children's academic performance in both public and private schools in Kenya. The researcher therefore seeks to establish the relationship, if any, between type of school and success of school feeding programme, and to determine the relationship, if any, between school feeding programme and academic achievement among the public primary school learners.

It is estimated that 60 million school-age children suffer from iodine deficiency disorders and that another 85 million are at risk for acute respiratory disease and other infections because they are deficient in vitamin A. The number suffering from iron deficiency anemia is greater than 210 million (Jamison *et al*, 1993).While universal primary school attendance is a stated goal by many governments and the millennium development goals

(MDG), enrollment rates continue to be low in many developing countries (UNESCO, 2007). To foster enrollment, many governments have eliminated primary school fees, as well as established programmes such as school feeding food programmes (Levinger, 1986).

Further, Adelman *et al*., (2007) and Levinger, (1986) observe that there are three major reasons that necessite school feeding programmes. First, the SFPs can motivate parents to enroll their children and see that they attend school regularly. Secondly, SFPs can improve the nutritional status of school age children over time, and alleviate short-term hunger in malnourished or otherwise well-nourished school children and thirdly, SFPs can improve cognitive functions and academic performance via reduced absenteeism and increased attention and concentration due to improved nutritional status and reduced short-term hunger. Indirectly, by increasing the amount of food available to the household, SFPs may improve the nutritional status of household members who are not in school, especially when SFPs entail take home rations. Overally, SFPs are appealing because if properly designed and implemented they lead to increased number of children being enrolled with better academic performances.

Research has shown that nutrition is important for cognitive and brain development; therefore, making healthy food choices becomes vital to a student's academic performance. Adverse effects of malnutrition on the cognitive functioning of children are well documented around the world, in particular, the negative effect of under nutrition (Kaestner and Grossman, 2009). In school meals provide an important nutritional

intervention during an often overlooked critical growth period. By providing food at school during the school day, there are two advantages. First, well-timed school meals alleviate short-term hunger, possibly improving students' ability to concentrate and learn. Second, they provide an incentive for school attendance directly to the child (Caldes and Ahmed, 2004). Therefore, the impact of in-school meals on learning appears to operate both through improvements in school attendance and better learning efficiency which may translate into high performance in schools. Thus, well-run SFPs that provide reasonably nutritious meals should have positive effect on school performance, childrens' health and the general dietary intake. However, the size of these effects depends on a number of factors. In some cases, they may be small or even null.

A study by Kibenge, (2005) established that in 1977 adult literacy rate was 12% for males and 6% for females. The 1991 census had 92-93 % of Karamojong children of school going age never having attended any school. In 1999, only 44% of the 68,468 girls and 68,325 boys of school going age were enrolled in school. Even this enrolment figure was plagued by high absenteeism and drop out rates. In contrast, the National literacy rate in the same period was 54%, overall, and 44.9% for females. Less than 12% of all Karamojong girls who enrolled in Primary (P1) one completed P7, compared to the national rate of 35%. Although Uganda had one of the highest economic growth rates over the last decade, 35% of the population still lives below the poverty line and this necessitated the introduction of school feeding programme to enhance academic performance. These findings were in tandem with the situation in Matete Sub-County, Kakamega County where by the literacy levels were below average, hence, attracted the

investment by World Vision to support the Education sector through ICT Project to improve the academic standards in Kakamega County. The available literature further, informed the researcher to control for this variable in order to get genuine results as far as the effect of WV-ICT Project on the performance of public primary schools in Kakamega County was concerned.

2.7 Textbook Ratios and Performance of Students

According to MoFPED, (2009), primary education has higher social returns compared to higher education. This, in turn, led to increased financing towards primary education with the share of primary education in the total education budget averaging to over 50 percent for the 13 years since the introduction of Universal Primary Education (UPE) in Uganda. As a result, investments were made in education and in particular to UPE programmes to match the increase in enrolment. More, especially, Government provided more education inputs such as additional teachers, classrooms, text books, staff houses and toilet facilities (Price Water House Coopers, 2000). Nonetheless, despite the increased supply of education inputs to primary schools, the quality of education in UPE schools had continued to decline (MoES, 2008). Further, the study established that Uganda had made tremendous progress in increasing access to primary education where by the enrolment rates increased from 16 percent in 1996 to 73 percent in 1997 and have increased at a rate of 5 percent every year since then (MoES, 2008). Nonetheless, this has not been matched by a proportionate increase in education inputs in order for the government to meet the Millennium Development Goals (MDGs) two and three. Indicators such as pupil-teacher ratio, pupil-classroom ratio and pupil-text book ratio were still below the government set targets as well as the international standards. This could partly explain the declining

quality in education outcomes as indicated by the Primary Leaving Examination (PLE) pass rates over time (UNEB, 2009).

Several studies have tried to establish the relationship between inputs and pupil performance. Studies done by Riddel and Brown (1991) drew conclusions that teaching resources availability and teaching methods were amongst the critical factors that influence the performance of primary schools. These findings triggered the researcher to find out the measures to undertake in order to avoid the influence of the text books as a moderator variable that could affect the performance of public primary schools in Kakamega County. The MDG 2: Achieve universal primary education. Specifically, Target 2A: By 2015, all children can complete a full course of primary schooling, girls and boys. Glewwe *et al* (2008) supported the view that pedagogical processes were more significantly related to pupil achievements than were the physical and pedagogical input variables and school organization. Research done previously by Lezoflee and Brancroft (1995), and that of Arrigada, (1981) emphasized regular assessment, working together in groups, giving pupils regular and timely feed back as key to pupil performance. In Uganda, Nannyonjo (2007) in her study on education inputs in Uganda found that inputs do matter, specifically inputs such as parent involvement in school environment and teacher characteristics played a great role in pupil learning achievements. This is applicable to the situation in Kakamega County given the fact that Uganda and western region of Kenya lies in the same geographical region of East Africa. This prompted the researcher to control for this factor in order to get accurate findings on the effect of ICT on performance of public primary schools in Kakamega County.To this effect, the government embarked on a very ambitious

programme of increased supply of education inputs in all public primary schools. However, pupil achievement in terms of numeracy and literacy differ across the County, and sometimes significantly. Unlike Nannyonjo's paper (2007) that focused more on primary six outcomes and various inputs, this study focused on the effect of text books related inputs such as resource availability and methods to explain differences in pupil achievement in KCPE. Of course, there is a general understanding of variables that are likely to impact on pupil performance but empirical evidence of the quantitative effects of these interventions is limited and mixed in other countries.

A number of studies have attempted to explore the links between the learning environment of the pupils and their performance (Wolff, 2002). There are also a number of national qualitative research case studies including those conducted by Price Water House Coopers (2000) for the Department of Education and Skills, United Kingdom; the Ministry of Education, New Zealand (2004); and some related examples in Architecture of Schools (Dudeck, 2000), that relate to pupil learning achievements and the influencing factors like the teaching methods and school resources.

According to the study by Castillow (2004), it was noted that pedagogical principles are pure, pristine, and packed with pedagogical power. With their generic nature, they can be applied to a wide variety of circumstances. For example, learning is facilitated when the instructor demonstrates and allows the learners to actively participate in learning experiences rather than merely telling what is to be learned. Pedagogical principles are also very pragmatic, in that they synthesize a rich set of practical, instructional experiences and can be used to deal with new practical problems.

Grimmitt, (2000) looks at the concept of pedagogical principles and school resources to a very abstract level, defining them as substantive hypotheses and facilitation about teaching and learning of the pupils. In particular, pedagogical principles and strategies, facilitate the process of devising better learning practices which, in turn, determine how pupils experience, engage with and respond to content. This stimulates improved learning outcomes. Ideally, learning and teaching better practices should first be expressed in generic terms and then in terms specific to the actual learning environment. Thus, the teaching and learning approaches are the more concrete actions designed to implement pedagogical principles and thereby fulfil or contribute to stated aims of better school performance (Boisiere, 2004).

It is noted that better teaching and learning practices are influenced greatly by national, cultural and contextual circumstances (Sosniak, 2005). Further, Kubanek-German (2003a) observes that teaching practices and methods are changing within a complex process of enduring educational innovation, itself due to societal change. Change occurs through a democratic dialogue or is enforced. The rationales for such methods change over time. During periods of innovation, teaching principles are refined and adapted based on experience. This occurs through the perception of day-to-day viability and the influence of the market, competition between authorities, research, parents and new societal developments such as ICT.

Actual counts of textbooks also revealed significant influence on pupil achievement (Heyneman and Jamison 1980). The research indicated a moderate effect of textbooks and

instructional material on achievement. In Malaysia, Beebout (1972) and in Chile (Schiefelbein and Farrell 1973), respectively, found that textbook availability was related to higher achievement.

Basing on the literature available, it was evident that text books have some positive influence on performance of schools. This informed the researcher to control for this variable whereby all the sample schools had text books supplied by the Government in equal ratios. Therefore, the text books could not have affected the outcome results of this study.

2.8 Knowledge Gaps

The Kenyan Government is committed to the provision of basic education through improved learning environment. The use of technology may be upheld at all levels of education given the fact that she has developed ICT Policy guidelines which provides a comprehensive legal framework that guide the development and utilization of Information Communication Technology(ICT) especially in basic educational institutions.

However, literature showed that in the development of ICT infrastructure, public primary schools was negligible. A study In the United Kingdom (UK), showed that the government spend £2.5 billion on Educational ICT in 2008-2009; in the united states, the expenditure on K-12 schools and higher Education Institutions was $6 billion and $4.7 billion respectively in 2008 and 2009 (Nut, 2010) while in New Zealand, the government spends over $410 million every year on schools' ICT infrastructure (Johnson, Hedditch &

Yin, 2011). On the contrary the Kenyan budgetary allocation defined is indefinite in terms of actual expenditure towards improvement of ICT infrastructure in practical perspective especially among the public primary schools.

Limited access to ICT-infrastructure is a stumbling block to effective utilization of technology during the process of curriculum implementation. Availability of software and hardware enhances efficient use of technology. The gap between the use of traditional teaching and learning approaches and the modern methods that embrace the integration of ICTs, calls for heavy investment in technological infrastructure in order to convert print-based subject content into digital media. Therefore this study may inform the government to define budgetary allocation to develop ICT infrastructure in public primary schools.

The researcher observed that there was a policy framework on ICT in Kenya that recognises the range of ICT infrastructure that have been used in the delivery of education to improve access, teaching learning and administration to include; Electric Board, Audio Cassette, Radio for interactive Radio instructions, video learning, computer, internet and ICT support applications systems (SAS). However, the major challenge in respect to these components is limited digital equipment at virtually all levels of education. While the average access rate is one computer to 15 (fifteen) students in most of the developed countries, the access rate in Kenya is about zero and this is because there is no documented evidence especially from public primary schools from Kakamega County. In addition it was noted through the Education Policy Framework (EPF) that in Kenya there are other challenges concerning access and use of ICT which include hindering students to access ICT facilities, limited rural electrification and frequent power disruptions among others.

However, the policy framework planned to give attention to the use of ICT to expand access and equity in the delivery of Education services and curricula. It was from this understanding that the researcher coined the objective to establish the correlation between ICT infrastructure and the performance of public primary schools in Kakamega County.

Looking at the literature available, the researcher noted with concern the pertinent role that ICT play in relation to the academic performance in schools. The knowledge gap was identified when the researcher realized the fact that most of the literature emanated from the Western Countries. None of the citation came from a Kenyan context especially from the public primary school perspective. This triggered the researcher to formulate an objective "to compare the academic performance of public primary schools that make use of ICT in teaching and learning processes against those which did not between the years 2008 and 2016 in Kakamega County."

Though ICT is a vital sector of the economy, requiring highly skilled professionals, it represents only a relatively small fraction of the total employment. This is in line with the recommendation by the Information Society(2002) which recommends that basic ICT skills should as fast as possible become a core component of mainstream education.The researcher was determined to ascertain the extent to which public primary schools in Matete Sub- County embraced and engaged the use of ICT experts if any and evaluated the extent to which this variable impacted on KCPE performance. This was unique in that the available literature only outlined the role of ICT experts but did not specify the employer and more so none derived its source from the developing countries, more so, Kenya

According to a study by Unachukwu and Nwankwo (2012) on principals readiness to use ICT for schools administration, revealed that most principals shy away from computers claiming that the innovation is for the youngsters. Furthermore many principals were handicapped as far as the use of ICT is concerned. This resulted to poor staff and student management as well as dismal student attainment. Nwalongo (2011) agrees with Unachukwu and Nwankwo (2012) that teachers do not use ICT to bring change in their practices but rather sustain their traditions. On the contrary, the current study will make use of questionnaires which will make the results to be more objective, hence, suitable for generalization. Secondly, this study is different from the available resources on ICT and the performance of learning institutions in that the kind of respondents used were new and also the location of the study was equally new. It was therefore necessary to conduct this study in order to enrich the development of informed policy guidelines from the local grass root level from the developing Countries.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This section presents the research design, location of the study, target population, sampling techniques and sample size, research instruments, data collection procedures, validity, reliability of the instruments and data analysis.

3.2 Research Design

In this study, descriptive Survey research design was employed. It enhanced the discovery of concepts and insights. Through Survey the researcher was able to gather relevant data concerning World Vision ICT Project. The study adopted inferential statistics in which quantitative perspectives whereby data was analyzed using mean scores, percentages, T-test, Chi-Square and Pearson's Product-Moment Correlation Coefficient. A survey of **s**chools covered by world vision ICT project and those not covered was done. Correlation of the research findings was done for both the WV-ICT and the non WV-ICT public primary schools. This is because according to Kothari (2008), correlation research facilitates collection of data from an accessible population in order to determine the current status and relationship between the issues under investigation. In this case, correlations facilitated collection of data related to the trends in KCPE performance of public primary schools covered and those not covered by World Vision ICT project between 2008 and 2016. Correlation design was considered appropriate for this study because according to Kasomo (2007) and Rubin *et al*., (2010), it ensured fair assessment of relationships of the sections of the targeted population.

3.3 Location of the Study

The research study was conducted in Matete Sub-County, Kakamega County of the Republic of Kenya. This was identified as a study area because it has schools which have benefitted and those which have not benefitted from the World Vision ICT Project from 2008 to 2016. Further, public primary schools in this location have participated in KCPE for a long time but still experiencing challenges in achieving quality grades in national examinations, hence, had the potential to yield tangible or essential information and knowledge about change in academic performance especially after the investment by World Vision ICT Project. Further to this, it was noted by Uwezo- Kenya (2010), that the area experiences low literacy levels in primary school classes relative to the acquisition of reading, writing and arithmetic skills. Uwezo-Kenya tests were administered to assess literacy and numeracy levels among individual learners in kakamega County. The literacy test entailed letter sounds, reading a word, reading a paragraph and reading a short story. Numeracy tests involved number recognition, place value and performing basic operations of addition and subtraction. The findings revealed that less than one in three Grade 3 pupils passed any of the three tests. Specifically 29% of Grade 3 pupils passed the numeracy test, while 25% passed the literacy test. One out of six or 16% pupils passed both the numeracy and literacy tests. Further, it was also established that only 20% of 3-8 year old children were able to tackle basic or real life mathematical problems and those 2 out of 3 learners in standard two were unable to read. One of the conclusions made was that, Many pupils in Kakamega County are not acquiring basic competencies as per the demands of primary school curriculum (ibid). This could have been as a result of weaknesses in the management of the available instructional resources which the researcher thought could

build a stronger foundation for performance in public primary schools' upper primary classes.

3.4 Target Population

According to Verma and Verma (2004) and Creswell (2002), study population is the unit whose characteristics one cares to describe by observing them. The target population of this study comprised of teachers and head teachers from a total of 52 identified public primary schools. Teachers are key informants in this study because they utilize ICT skills during lesson instruction and have the potential to evaluate the actual use of ICT knowledge and skills in the target primary schools. For the purpose of this study, 18 teachers trained by World Vision in ICT and 18 from non-WV-ICT schools. The researcher also sampled 18 head teachers managing WV-ICT public primary schools and another set of 18 head teachers from non-WV-ICT schools for comparative purposes.

3.5 Sampling Procedure and Sample Size

According to Kellinger (1983) and Kothari (2010) determination of the sample size in a study is to keep the sample representative of the target population. This enhances the study to derive detailed data at an affordable cost in terms of time, finances and human resources (Kathuri & Pals, 1993). The sampling frame had Kakamega County sampled purposively; teachers and head teachers, to investigate value addition as a result of the World Vision ICT Project in Kakamega County. Purposive sampling was adopted because according to Kombo (2010) and Kothari (2010), the technique is appropriate in studies like this one dealing with various groups of respondents derived from schools covered by the world vision ICT project and those not covered. Thus, purposive sampling is to facilitate

coverage of sections of the target population from both clusters in the County. Moreover, purposive sampling provided an opportunity for the researcher to be objective in identifying the source of relevant data which made the study to be cost effective in terms of resource utilization. Gay (1992), notes that a target of 20% is the minimum to be considered for small populations. Based on this argument, samples were selected using census and purposive techniques and are shown in table 3.1

Table 3.1: Sample Size Distribution

Category	Teachers		Head Teachers	
	M	F	M	F
World Vision Project schools	10	8	13	5
Non world vision schools	10	8	15	3
Total	**20**	**16**	**28**	**8**

Source: Kakamega County Education Office, April, 2018.

A population of 52 Public Primary Schools was divided into 2 administrative stratums where census sampling technique was used to sample all WV- ICT project schools (18). Simple random sampling technique was used to select 18 non WV-ICT Schools. This represented 53% out of the 34 non WV-ICT primary schools from Matete Sub-County. This sample was far much above the recommended target by Gay(1992) and also emphasized by Bernard(1995) who observes that characteristics of the study population determine which and how many people may be selected for a study sample. Further, the criterion for selecting the 18 non WV-ICT schools was guided by the fact that there was

need for equal number of sample schools from either set within the targeted stratums for comparison purpose.

3.6 Data Collection Instruments

According to Creswell (2009) research instruments are tools designed to enable the researcher to collect the intended information from the respondents. In this study, the type of data to be collected were related to establishment of the difference in academic performance of public primary schools with ICT infrastructure and those without between 2008 and 2016 in Matete Sub-County; finding out the correlation in academic performance of public primary schools using ICTs in teaching and learning and those which do not in Matete Sub-County; determination of the correlation between academic performance of schools with and without ICT technical support and establishment of the relationship between teachers' perceptions and the use of ICTs in Public primary schools in Matete Sub-County. Questionnaires were used to collect data from the respondents.

3.6.1 The questionnaire

According to Nsubuga (2000) questionnaires are used by educators to obtain inquiries concerning attitudes and opinions. Questionnaires were used in this study because they collect more data from respondents and are easy to administer. The questionnaires were developed on the basis of the research objectives. The questionnaire for teachers and head teachers were divided into four sections. The first section was to seek the teachers' biographical data; the second section had items about the establishment of the difference in academic performance of public primary schools with ICT infrastructure and those without between 2008 and 2016 in Matete Sub-County; the third section addressed items on

correlation of the academic performance of public primary schools using ICTs in teaching and learning and those which did not in Matete Sub-County. The fourth section sought the determination of the relationship between academic performance of schools with and without ICT technical support and the last section dealt with items on establishment of the relationship between teachers' perception and the use of ICTs in Public primary schools in Kakamega County.

The review of related literature guided the generation of the items in the questionnaire. The closed ended section of the questionnaire made use of a five point likert scale model (Bordens and Abbott, 2005) whereby a rating scale with items ranging from Strongly Disagree (SD), Disagree (D), Undecided (U), Agree (A) and Strongly Agree(SA) and were scored as follows; Strongly Disagree (SD)-1 Disagree (D)-2, Undecided (U)-3, Agree (A)-4 and Strongly Agree(SA)-5. The researcher embraced closed forms of questions in questionnaires since they are easy to administer and fill out, hence, assisted the teachers' mind to be focused on the subject and facilitated the process of tabulation and analysis. They also helped to check on irrelevance and as a result time wasting was limited. Open spaces were left for the respondents to comment freely on any other issues related to the study which was not covered in the closed ended section for respondents to express their opinions freely.

3.7 Validity and Reliability of Instruments

3.7.1 Validity

Validity refers to the accuracy and meaningfulness of the inferences which are based on the research results. It is the degree to which results obtained from the analysis of the data actually represents the phenomenon under study (Orodho, 2008 & Kothari, 2010). Content validity refers to the adequacy that the test samples the subject matter in question (Cohen *et al* 2000). Construct validity is the degree to which test items relate to the available empirical data, logical analysis and debate. It is achieved when test items are indicators of the underlying latent construct in question. Concurrent validity refers to the extent to which test results concur with those of other tests that may be testing the same construct. In reference to specific type of validity, the test must demonstrate fitness of purpose for it to be effective. To enhance the content validity of the research instruments, Educational Planning and Management (EPM) doctoral class student colleagues proof read the research document. Also, consultations and discussions with the supervisors, lecturers and research experts from the department of Educational Planning and Management (EPM) helped the researcher in verifying the face and content validity of the research instruments. Items found to be inadequate for measuring the variables were modified to improve the quality of the research instruments.

3.7.2 Reliability of instruments

Reliability which measures the degree to which a research instrument yields consistent results was done to ensure stability of the research instruments. Reliability of research instruments was ascertained through observer reliability approach through which different raters/observers gave consistent answers or estimates as postulated by Kombo, & Tromp,

(2006) and Kothari (2010). Responses obtained during the piloting were used to calculate a reliability coefficient score using Stata analytical programme.

The reliability of instruments was established through test-retest procedure based on Pearson's Product- moment Correlation Coefficient score against a coefficient score of 0.7 as recommended by Oso and Onen, (2011). The researcher administered the same test items to the selected sample twice within an interval of three months. The findings of each test were subjected to Pearson's Product -moment Correlation Coefficient test statistc using the formula:

$$PX,Y = \frac{\text{cov}(X,Y)}{\sigma_X \sigma_Y}$$

Whereby;

P= Population Pearson's Product-moment Correlation Coefficient

Cov = Covariance

σ_X = Standard deviation of X

σ_Y = Standard Deviation of Y

Covariance between x and y was established that on average the structured questionnaires for teachers had a reliability coefficient score of 0.78 and that of head teachers was 0.72. Since these reliability coefficient scores were above 0.7, both instruments were adapted.

3.8 Piloting

After validation of the research instruments a pilot study was carried out among 6 teachers whereby 3 were sampled from primary schools covered by the world vision ICT project

and vice versa. Teachers who participated in the pilot study were not included in the main study. Likewise, 6 head teachers from either side of the public primary schools participated in the pilot study. Thus, from WV-ICT Project schools and vice versa. The results of the pilot study were used to review the instruments by adjusting ambiguous items.

3.9 Data collection procedure

The researcher sought approval by the Directorate of Postgraduate studies to obtain a research permit from the National Council for Science and Technology (NACOSTI) before embarking on the actual process of data collection. Further authority to collect data in the County was sought from the Sub-County Administrators from individual Sub- Counties and the Sub-County Directors of Education from specific Sub-Counties within the Kakamega County. Head teachers were approached through the area Education offices and the school head teachers gave the researcher permission to interact with relevant regular teachers from the sampled public primary schools in Kakamega County. Further, the researcher created a rapport with the respondents and sought their consent before engaging them as active respondents of the study because good relationship with the respondents motivated them to respond to the questions willingly and on time.

3.10 Data Analysis Approaches

The process of data analysis involved the organization, manipulation and consideration of the meaning (Miller & Salkinud, 2002). Before analysis, data were processed to eliminate unsuitable information. It was coded and stored electronically. Stata Analytical Programme was used to process the row data. Data were analyzed quantitatively using inferential statistics to make deductions, interpretations, conclusions and possible recommendations.

Quantitative data was elicited from the closed ended questions in the questionnaire where means, frequencies and percentages were computed and presented through tables and figures. The open ended sections of the questionnaires were not responded to, hence, there was no qualitative data analyzed. Prior to analysis data were checked and entered into the software taking into cognizance their serial numbers and codes for each item. Data cleaning and management was thereafter undertaken. Specific variables used in the study were analyzed inferentially. The variables included school KCPE mean scores against the independent variables.

The first objective of this study was to establish the difference in academic performance of public primary schools with ICT infrastructure and those without between 2008 and 2016 in Kakamega County. In order toaddress this objective, two tailed Independent sample t-test was used to compare school KCPE mean scores for the WV-ICT and non WV-ICT public primary schools. The use of two tailed Independent sample t-test was convenient in data analysis because the study was comparing performance of students from two categories of schools, those covered by the world vision ICT project and schools which did not benefit from the World Vision ICT project. The choice of the statistical test was further informed by the fact that the dependent variables were measured in a continuous scale, thus interval or ratio. Further, Pearson's Product Moment Correlation Coefficient helped in determining the correlation between the Independent variables and the outcome variable within public primary schools in Kakamega County. Testing of the null hypothesis was done after the analysis for each of the four objectives of the study.

Post estimation tests for normality were conducted to test the validity of the hypothesis and estimation of the distribution errors in coefficients. The tests included the kernel density estimate (kdensity) for normality of residuals in all the four study objectives. Further, the Shapiro Wilk (Swilk) tested for the normal distribution of residuals in the hypothesis. The Skewness/Kurtosis (SKtest) test for normality was used to verify the alpha values in order to reject or fail to reject the null hypothesis.

On testing for linearity where the relationship between the predictors and the outcome variables should be linear, the Scatter plot was run. The Omitted Variables (OVtest) was run to find out if there were any omitted variables in the model. Thereafter, the Link test was run to test for the model specification while running the regression.

The last post estimation test to be conducted in this study was the test for independence/Collinearity/Multicollinearity. In this test, a condition index was used to determine the stability of the regression coefficients. Stata command to chek for multicollinearity is the variance inflation factor (vif), whereby vif > 10 or vif < 0.10 indicates trouble in the regression model (Stock and Watson, 2003).

The post estimation tests were conducted in all the study objectives except for objective four where the Fisher's exact values were used to establish the correlations between the covariates. A summary of the analytical tests conducted in this study is shown in Table 3.2.

Table 3.2: Operationalization of Variables

Objective	Variables	Indicators	Measurement scale	Data instrument	Data analysis
To establish the difference in academic performance of public primary schools with ICT infrastructure and those without between 2008 and 2016 in Kakamega County	**Independent Variable:** ICT infrastructure	No. of ICT tools and facilities	Interval	Questionnaire	Descriptive Statistics, Two tailed Independent sample t-test. Pearson Product-moment Correlation Coefficient, Multiple Linear Regression Coefficients, Post estimation Tests: Testing for normality and Testing for Linearity
	Dependent variable: Academic performance	KCPE Mean scores	Ratio	Questionnaire	Means, percentages and Two tailed Independent sample t-test
To compare the correlation in academic performance of public primary schools using ICT in teaching and learning and those which did not in Kakamega County	**Independent variable:** Use of ICT in teaching/learning	Teacher motivation Access to ICT tools Application of ICT skills Further training	Ratio	Questionnaire	Descriptive Statistics, Two tailed Independent sample t-test, PPMCC, Multiple Linear Regression, Simple Linear Regression, Post estimation tests: Testing for Normality, Testinng for Linearity
	Dependent variable: Academic performance	KCPE mean scores	Ratio	Questionnaire	Pearson Product –moment correlation coefficient

To determine the correlation between performance of public primary schools with and without ICT Technical support in Kakamega County	**Independent variable:** ICT technical support	Trained teachers Evaluation programme Time for practice No. of ICT tools	Ratio	Questionnaire	Descriptive Statistics, Pearson's Product-moment Correlation Coefficient, Multiple linear Regression Coefficients, Post estimation Tests for Normality and Linearity
	Dependent variable: Academic performance	No. of ICT tools Frequency in application of tools Record keeping No. of personnel employed Working environment	Interval Ratio	Questionnaire	Descriptive Statistics, means, percentages and Pearson's Moment Correlation Coefficient
To establish the correlation between teachers' perceptions and ICT use in public primary schools in Kakamega County	**Independent variable**: Teachers' sex, experience, and Educational level	Teacher motivation Access to ICT tools Application of ICT skills Further training	Ratio	Questionnaire	Means, percentages and Chi-square /Fisher's exact
	Dependent variable: Academic performance	KCPE mean scores	Ratio	Questionnaire	Percentages, Means and Chi-square/Fisher's exact

3.11 Ethical issues in Research

The research study observed ethical principles underpinning research procedures in planning and conducting research (Cohen, et al, 2000). The researcher ensured proper acknowledgement by citing, recording and analyzing of collected data. Confidentiality of the information given by respondents was observed by the researcher. Data collection was conducted through public primary schools following a research permit obtained from the National Council of Science Technology Innovation (NCSTI). Further, the objectives and benefits of the study were explicitly explained to the participants.

During the actual data collection process, the researcher sort informed consent in order to interact with the respondents. Confidentiality of the information gathered from the respondents was observed. The respondents were not expected to indicate their names and names of their schools in the questionnaires. Above all, the objectives and benefits of the study were explained to the participants.

CHAPTER FOUR

DATA ANALYSIS,PRESENTATION, INTERPRETATION AND DISCUSSIONS

4.1 Introduction

This chapter presents the results of this study on the effect of world vision ICT project on academic performance of public primary schools in Kakamega County. The findings are presented in line with the four research objectives which were: to establish the difference in academic performance of public primary schools with ICT infrastructure and those without between 2008 and 2016; to compare the academic performance of public primary schools using ICT in teaching and learning and those which did not; to determine the correlation between ICT technical support and academic performance of public primary schools and finally,to establish the correlation between teachers' perceptions and the use of ICT in Public primary schools in Kakamega County. The findings of this study are presented using tables followed by discussions as per the individual objective.

4.2 Sample Distribution

Data for this study were collected from public primary schools in Matete Sub-County, Kakamega County. In this study respondents were to indicate their gender and whether their school was among those covered by the WV-ICT project or not. This information was useful in determining gender parity in the staffing of teachers in public primary schools in the Sub-County as well as explaining the level of exposure to ICT infrastructure. The questionnaires for the head teachers and those for the regular teachers were administered by the researcher one on one. This approach ensured 100% response rate. Table 4.1 presents a cross tabulation of the sample by whether the school benefited from the WV-ICT project and further indicating the gender of the respondent.

Table 4.1: Sampled Schools by their WV-ICT Status and Gender of Teachers

School WV-ICT Status	Gender of Teacher		Total
	0=Female	1=Male	
0=Non WV-ICT school	7	11	18
	38.89	61.11	100
	50	50	50
1=WV-ICT school	7	11	18
	38.89	61.11	100
	50	50	50
Total	14	22	36
	38.89	61.11	100
	100	100	100

Note. WV= World Vision; ICT=Information Communication Technology/
Pearson chi2(1) = 0.0000 Pr = 1.000 Cramér's V = 0.0000
Source: Stata, output, 2019

The results in Table 4.1 indicate that a sample of 14 (38.89%) female and 22 (61.11%) male teachers participated in the research study. When the data were subjected to the Pearson Correlation Coefficient data analysis test statistic, the Pearson chi2 (1)=0.0000, pr=1.000, Cramer' V= 0.0000 confirmed the fact that there was no statistically significant relationship between whether the school is WV-ICT covered and the gender of the teacher which is good for sample distribution.

According to Kothari (2010) researchers select a sample because of various limitations that may not allow researching on the entire population. In this study, the researcher selected the sample purposively and thereafter simple random approach was used to identify potential respondents from both WV-ICT schools and the non WV-ICT project schools in order to compare and contrast the findings.

4.2.1 Variables Used in the Study and their Measurement

The variables used in the data analysis in this study are presented in table 4.2.

Table 4.2: Description of Variables used in the Analysis of the Data

Variable	Variable label	Variable scale	Min	Max
z_s2tm	Schools mean z-score	Interval	-1.68	2.77
t23a3	Strongly agree: Creating & using Microsoft offices in schools	Dummy	0	1
s16	School is WV-ICT covered	Nominal	0	1
s18	School has a feeding programme	Nominal	0	1
t11	Male teacher	Nominal	0	1
t12	Teacher education	Categorical	1	3
t14	Deputy H/Teacher	Nominal	0	1
t15	Teacher's working exp in Kakamega county	Categorical	1	6
s41a4	Strongly agree: Teachers use ICT for instructional purpose	Dummy	0	1
s424a4	Strongly agree: Communicate effectively with families and involving them in student learning and the school community	Dummy	0	1
s45a2	Agree: Computers create awareness and raise learning opportunities	Dummy	0	1
s45a3	Strongly agree: Computers create awareness and raise learning opportunities	Dummy	0	1
s49a2	Undecided: Teachers believe ICT initiative is a health hazard	Dummy	0	1
s411a4	Strongly agree: Support all students to learn what is planned for them through IT	Dummy	0	1
s412a4	Strongly agree: Build on students prior knowledge experience to use IT	Dummy	0	1
s416a4	Strongly agree: Creating physical environments that engage all students in purposeful learning activities	Dummy	0	1
s428a2	Agree: Display practical ICT skills in various subject content	Dummy	0	1
s428a3	Strongly agree: Display practical ICT skills in various subject content	Dummy	0	1
t31a2	Strongly agree: Teachers use ICT for instructional purpose	Dummy	0	1
t323a2	Strongly agree: Learn about and work with local communities to improve teacher professional practice to promote IT	Dummy	0	1
t325a3	Strongly agree: Work collegially with all school staff to promote IT skills	Dummy	0	1
s55a1	Agree: Regular breakdown of digital signals/network	Dummy	0	1

Note. Min=Minimum; Max=Maximum

Source: Stata output, 2019

Table 4.2 presents the variables used in the data analysis which includes Interval, Nominal, Categorical and dummy. Out of the total number of variables used (22), one (1) was interval, four (4) were nominal, two (2) were categorical and fifteen (15) were dummy. The independent variable was the school covered with the World Vision ICT Project. This was presented as nominal variable such that schools under investigation fall under WV-ICT covered or not. The variable was analyzed under description of variables. The results indicated that there were 18(50%) schools which benefitted from the WV-ICT project in Matete Sub-County.

The variable as to whether the school was covered with WV-ICT project and whether it had a feeding programme was also analyzed under description of variables. The results revealed that only two (2) schools had a feeding programme. This represented 11.11% of the total number of WV-ICT schools (18).

Teachers' perceptions were analyzed as dummy variables and were used in the analysis of objective four (4). Teacher's qualification and working experience were categorical variables which were analyzed in the background information.

4.2.2 Descriptive Statistics of Variables Used in Data Analysis

The research study generated descriptive statistics for the variables used in data analysis. The descriptive statistics indicated specific variables, variable labels, means, se (means), standard deviations, minimum and maximum scores. Details are indicated in Table 4.3.

Table 4.3: Descriptive Statistics for variables used in the analysis of the data

Variable	Variable label	Mean	se(mean)	Std.Dev.	Min	Max
z_s2tm	Schools mean z-score	0.00	0.17	1.00	-1.68	2.77
Frequencies and percentages for nominal, Dummy and Categorical variables (percentages in parentheses)						
t23a3	Strongly agree: Creating & using Microsoft offices in schools 0=OTHERWISE 30 (83.33); 1=YES 6 (16.67)					
s16	School is WV-ICT covered 0=NO 18 (50.00); 1=YES 18 (50.00)					
s18	School has a feeding programme 0=NO 20 (55.56); 1=YES 16 (44.44)					
t11	Male teacher 0=FEMALE 11 (30.56); 1=MALE 25 (69.44)					
t12	Teacher education 1=P1 22 (61.11); 2=DIPLOMA 9 (25.00); 3=B.Ed DEGREE 5 (13.89)					
t14	Deputy H/Teacher 0=NO 30 (83.33); 1=YES 6 (16.67)					
t15	Teacher's working exp in Kkg county 2=1-5yrs 10 (27.78); 3=6-10yrs 7 (19.44); 4=11-55yrs 11 (30.56); 5=16-20yrs 4 (11.11); 6=>20 yrs 4 (11.11)					
s41a4	Strongly agree: Teachers use ICT for instructional purpose 0=OTHERWISE 25 (69.44); 1=YES 11 (30.56)					
s424a4	Strongly agree: Communicate effectively with families and involving them in student learning and the school community 0=OTHERWISE 31 (86.11); 1=YES 5 (13.89)					
s45a2	Agree: Computers create awareness and raise learning opportunities 0=OTHERWISE 28 (77.78); 1=YES 8 (22.22)					
s45a3	Strongly agree: Computers create awareness and raise learning opportunities 0=OTHERWISE 13 (36.11); 1=YES 23 (63.89)					
s49a2	Agree: Teachers believe ICT initiative is a health hazard 0=OTHERWISE 25 (69.44); 1=YES 11 (30.56)					
s411a4	Strongly agree: Support all students to learn what is planned for them through IT 0=OTHERWISE 31 (86.11); 1=YES 5 (13.89)					
s412a4	Strongly agree: Build on students prior knowledge experience to use IT 0=OTHERWISE 28 (77.78); 1=YES 8 (22.22)					
s416a4	Strongly agree: Creating physical environments that engage all students in purposeful learning activities 0=OTHERWISE 28 (77.78); 1=YES 8 (22.22)					
s428a2	Agree: Display practical ICT skills in various subject content 0=OTHERWISE 26 (72.22); 1=YES 10 (27.78)					
s428a3	Strongly agree: Display practical ICT skills in various subject content 0=OTHERWISE 11 (30.56); 1=YES 25 (69.44)					
t31a2	Strongly agree: Teachers use ICT for instructional purpose 0=OTHERWISE 17 (47.22); 1=YES 31 (52.78)					
t323a2	Strongly agree: Learn about and work with local communities to improve teacher professional practice to promote IT 0=OTHERWISE 29 (80.56); 1=YES 7 (19.44)					
t325a3	Strongly agree: Work collegially with all school staff to promote IT skills 0=OTHERWISE 30 (83.33); 1=YES 6 (16.67)					
s55a1	Agree: Regular breakdown of digital signals/network 0=OTHERWISE 33 (91.67); 1=YES 3 (8.33)					

Note. Min=Minimum; Max=Maximum; se(mean)=Standard Error of the Mean; Std.Dev.=Standard Deviation

Source: Stata output, 2019

The descriptive statistics in Table 4.3 indicate that the sample size was evenly distributed dependent to specific cluster, thus whether the school was covered by WV-ICT project or not. The effect of WV-ICT project was the outcome variable and was used in the analysis of all the four (4) objectives of this study. From the analysis 18 public primary schools which formed 50% of the total sample of the schools under investigation had WV-ICT programme. These findings indicate a balance in the choice of sample schools in Kakamega County.

Further, the preliminary results in Table 4.3, suggest that equal number of teachers from either side, thus, WV-ICT covered school or not covered were identified as potential respondents of this research study. Matete Sub-County had 52 registered public primary schools but only 18 had benefited from the world Vision ICT project. The researcher sampled all the 18 WV-ICT schools as a census and compared with another 18 non- WV-ICT public primary schools which were randomly sampled from the same catchment area. The 18 non-WV- ICT schools could provide easy time when comparing their KCPE results during data analysis. The study also generated descriptive statistics from perceptions of teachers with varied characteristics which included gender, educational levels, ICT training and the teaching experience of individual teachers from the sampled schools.

4.3 Objective 1: The Difference in Academic Performance of Public Primary Schools with ICT Infrastructure and those Without Between 2008 and 2016 in Matete Sub-County.

The first objective of this study was to establish the difference in academic performance of public primary schools with ICT infrastructure and those without between 2008 and 2016 in Kakamega County. In order to address this study objective, two tailed independent t-test was used to compare school KCPE mean scores between the WV-ICT and non WV-ICT schools. Further, the Pearson's Product-moment Correlation Coefficients test statistic was used to fit the multiple linear regression coefficients on the effect of World Vision ICT infrastructure on school KCPE mean scores, while controlling for school characteristics.

4.3.1 Correlation Matrix for Objective 1

In the first objective of this study the researcher tested the hypothesis that there is no statistically sigficant difference in academic performance of public primary schools covered by the WV-ICT infrastructure and those without in Matete Sub-County using a Pearson Product-Moment Correlation Coefficient whereby $\alpha = 0.05$ level of significance. In order to fit the regression, the study was to establish the difference in academic performance of primary schools with ICT infrastructure and those without. After subjecting collected data to the Pearson's Product-moment correlation coefficient statistical test, the outcome results are shown in Table 4.4

4.3.1.1 Correlation Matrix between Outcome Variable, Explanatory Variable and Covariates

The results of the correlation matrix between the outcome variable, xxplanatory variable and the covariates are shown in Table 4.4.

Table 4.4: Correlation Matrix Between the Outcome Variable (z_s2tm), the Explanatory Variable (t23a3) and the Covariates for School Academic Performance, Objective 1.

Variable		z_s2tm	t21a1	t21a2	t22a1	t22a2	t23a1	t23a2
z_s2tm		1						
t21a1	A	0.150	1					
	B	0.383						
t21a2	A	-0.150	-1.000	1				
	B	0.383	1.000					
t22a1	A	-0.066	-0.060	0.060	1			
	B	0.701	0.729	0.729				
t22a2	A	0.066	0.060	-0.060	-1.000	1		
	B	0.701	0.729	0.729	0.000			
t23a1	A	0.018	0.109	-0.109	0.130	-0.130	1	
	B	0.915	0.529	0.529	0.451	0.451		
t23a2	A	0.319	0.120	-0.120	0.196	-0.196	-0.454	1
	B	0.058	0.488	0.488	0.251	0.251	0.005	
t23a3	A	-0.368	-0.200	0.200	-0.299	0.299	-0.109	-0.837
	B	0.027	0.242	0.242	0.077	0.077	0.529	0.000
t24a1	A	-0.208	-0.076	0.076	0.316	-0.316	0.041	0.181
	B	0.223	0.661	0.661	0.060	0.060	0.812	0.292
t24a2	A	0.208	0.076	-0.076	-0.316	0.316	-0.041	-0.181
	B	0.223	0.661	0.661	0.060	0.060	0.812	0.292
t26a1	A	-0.094	0.181	-0.181	0.263	-0.263	0.070	0.124
	B	0.587	0.291	0.291	0.122	0.122	0.684	0.473
t26a2	A	0.094	-0.181	0.181	-0.263	0.263	-0.070	-0.124
	B	0.587	0.291	0.291	0.122	0.122	0.684	0.473
t27a1	A	-0.014	0.135	-0.135	0.161	-0.161	-0.073	0.161
	B	0.937	0.433	0.433	0.348	0.348	0.672	0.348
t27a2	A	0.014	-0.135	0.135	-0.161	0.161	0.073	-0.161
	B	0.937	0.433	0.433	0.348	0.348	0.672	0.348
t28a1	A	-0.282	-0.086	0.086	0.154	-0.154	-0.140	0.000
	B	0.096	0.618	0.618	0.369	0.369	0.415	1.000
t28a2	A	0.282	0.086	-0.086	-0.154	0.154	0.140	0.000
	B	0.096	0.618	0.618	0.369	0.369	0.415	1.000
t29a1	A	-0.226	0.200	-0.200	0.060	-0.060	-0.109	0.060
	B	0.186	0.242	0.242	0.729	0.729	0.529	0.729
t29a2	A	0.226	-0.200	0.200	-0.060	0.060	0.109	-0.060
	B	0.186	0.242	0.242	0.729	0.729	0.529	0.729
t210a1	A	-0.281	-0.129	0.129	0.124	-0.124	0.070	-0.155
	B	0.097	0.452	0.452	0.473	0.473	0.684	0.368
t210a2	A	0.281	0.129	-0.129	-0.124	0.124	-0.070	0.155
	B	0.097	0.452	0.452	0.473	0.473	0.684	0.368
t211a1	A	-0.070	0.109	-0.109	0.130	-0.130	-0.059	0.130
	B	0.686	0.529	0.529	0.451	0.451	0.733	0.451
t211a2	A	-0.206	0.086	-0.086	0.154	-0.154	-0.140	0.000
	B	0.228	0.618	0.618	0.369	0.369	0.415	1.000
t211a3	A	0.228	-0.135	0.135	-0.210	0.210	0.161	-0.065
	B	0.181	0.433	0.433	0.220	0.220	0.349	0.709

Note: a=Pearson correlation coefficient; b=p-values (α=0.05); Pair-wise correlation: ≤0.35 = Weak correlation; 0.36-0.67 = Moderate correlation; 0.68-0.89=Strong correlation; ≥0.90 = Very strong correlation; Adapted from "Interpretation of correlation coefficient, " by R. Taylor, 1990, Journal of Diagnostic Medical Sonography, 6(1), p. 37

Source: Stata Output,2019

The first research objective was to establish the difference in academic performance of public primary schools with ICT infrastructure and those without. A Pearson Product-Moment Correlation Coefficient was conducted to establish the difference in academic performance of public primary schools with ICT infrastructure and those without. The test results shown in Table 4.6 indicate that the outcome variable was not significantly different. The output (p=0.2033) indicates that there is no statistically significant difference in academic performance of public primary schools with ICT infrastructure and those without. These findings contradict the results of the study by Harrison *et al* (2004) who identified statistically significant findings positively associating higher levels of ICT use with school performance at each stage and in English, Mathematics, Science, Modern foreign languages and design technology.

An association between high ICT use and higher pupil attainment in public primary schools was also reported in an earlier teacher training agency study by Moseley *et al* (1999. p82) though the interpretation by researchers was that more effective teachers, tended to use more innovative approaches or chose to use ICT resources that they had more appropriately, rather than that the technology itself was the cause of the differences in pupil's performance. The connection between technology and learning is fairly consistent and other studies have indicated a stronger association. The ICT test bed evaluation identified a link between high levels of ICT use and improved school performance whereby the rate of improvement was faster in ICT Test Bed local Authorities than in equivalent comparator local Authorities in KS2 English (Somekh *et al* 2007). The

causal link could be the reverse, with high performing schools more likely to have better equipment or more prepared to invest in technology.

However, in this study the results revealed that WV-ICT schools have a higher mean of .2149262 compared with a lower mean of -.2149262 for non WV-ICT schools. These means are not statistically different from each other, p=0.2033. In other words, the difference of -.4298523 between the means is not statistically different. Given the fact that ICT infrastructure is key in educational processes and this is because Studies conducted by Kulik and Kulik (1991) analysed results from respondents on the question as to whether ICT usage results to better educational outcomes amongst learners of all age levels. It is noted that computer based instruction usually impacts the pupils outcomes positively with computer based teaching raising pupils' examination scores significantly. Moreover, it helps pupils in acquiring a more in depth understanding of subject material, challenge pupils' thinking and understanding and improves their problem solving skills.

Cox *et al* (2003) found evidence of a statistically significant and positive impact of ICT on pupil attainment in a lot of academic subjects. The evidence of a positive effect of ICT on the pupils' attainments appeared to be particularly robust in core subjects in the curriculum for instance Mathematics, Science and languages.

Further, a study by Cuban and Kirkpatrick (1998) and by Becta (2007) realised mixed results and concluded that there is no tangible evidence on the effectiveness of ICT in academic achievement. These findings contradict Cheung and Slavin (2013), who noted that ICT applications produce modest but positive impacts on mathematical achievements in comparison to traditional instructional methods. These mixed reactions prompted the

researcher to conduct analysis of the dummy responses to establish more facts with regard to the effect of ICT infrastructure use in relation to the performance of public primary schools in Kakamega County.

4.3.2 Two Tailed Independent t-test Comparing school KCPE Mean Scores Between WV-ICT and non WV-ICT Schools

When data was subjected to the two-tailed independent t-test comparing the school KCPE mean scores between WV-ICT and non WV-ICT schools, the results indicated in Table 4.5 were realized:

Table 4.5: Two-tailed independent t-test comparing school KCPE Mean Scores (z_s2tm) Between WV-ICT and non-WV-ICT Schools

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Group	Obs.	Mean	Std. Err.	Std. Dev.	[95% CI]	
0=Non WV	18	-0.21	0.17	0.74	-0.58	0.15
1=WV-ICT	18	0.21	0.28	1.19	-0.38	0.81
Combined	36	0.00	0.17	1.00	-0.34	0.34
Difference		-0.43	0.33	-1.11	0.25	5.38
Cohen's *d* (measure of effect size)		-0.4341			-1.092	0.203

Note. Obs.=Observations; Std. Err=Standard Error; Std. Dev.=Standard Deviation; CI=Confidence Interval; WV=World Vision; ICT=Information Communication Technology *n*=36; α=.05

t (28.3006) = -1.3023, *p*=0.2033

Source: Stata output, 2019

The results in Table 4.5 indicate that the WV-ICT schools have a higher mean of .2149262 compared with -.2149262 for non WV-ICT schools in Kakamega County. However, these means are not statistically different from each other, *p*=0.2033.

In other words, the difference of -.4298523 between the means is not statistically different. These results prompted the researcher to pursue dummy responses because they were similar to the findings generated from the Pearson's Product-moment Correlation Coefficient test statistic.

4.3.3 Two Tailed Independent t-test Comparing school KCPE Mean Scores Between the Dummy Responses

When the research data were further subjected to a two tailed independent t-test comparing school KCPE mean scores between dummy responses, the results shown in Table 4.6 were realized.

Table 4.6: Two-tailed independent t-test comparing school KCPE Mean Scores (z_s2tm) for Dummy t23a3.

Group	Obs.	Mean	Std. Err.	Std. Dev.	[95% CI]	
0=Otherwise	30	0.16	0.18	0.98	-0.21	0.53
1=Strongly Agree	6	-0.81	0.27	0.66	-1.50	-0.12
Combined	36	0.00	0.17	1.00	-0.34	0.34
Difference		0.97	0.32		0.25	1.69
Cohen's *d* (measure of effect size)		1.0307			0.114	1.933

Note. Obs.=Observations; Std. Err=Standard Error; Std. Dev.=Standard Deviation; CI=Confidence Interval; t23a3: 0=Otherwise; 1=Strongly agree that creating & using Microsoft offices in schools improves KCPE mean scores; n=36; α=.05;
t (10.1131) = 3.0062, p=0.0130

Source: Stata output, 2019

When a two tailed independent t-test was conducted to compare school KCPE mean scores for dummy t23a3,the results indicated in Table 4.6, t(10.1131)= 3.0062,p=0.0130, were realized. The effect size based on Cohen's d: 1.0307, were statistically insignificant. The correlation coefficient indicates that there is insignificant correlation between the KCPE mean scores for non WV-ICT and WV-ICT schools. When interpreting the effect of an intervention the Cohen's d- effect size such as (0.2) is small,(0.5) medium and (0.8) is large are used. Cohen's d is an appropriate effect size used to indicate the standardized difference between two means (Cohen, 2003). In this study, it was used to determine the difference between mean scores for the dummy responses from the results of a two tailed independent t-test. The sign of Cohen's d depends on which sample means is labeled 0 and 1. If M0 is

bigger than M1, the effect size will be positive and if the second mean is larger, the effect size will be negative (Hungi & Thuku, 2010; Ejakait et al, 2016a; 2016b). For the case of this research study, the results were large (Cohen's d: 1.0307). Therefore the difference between KCPE mean scores of public primary schools with World Vision ICT Project and those without were statistically significant. These findings are in tandem with the results of the study by Seo and Woo (2010) who found the effects of computer assisted instruction programme that is developed to remediate specified mathematical skills amongst learners with special needs. They found that the computer assisted instruction programme may be an effective tool for helping pupils with learning disabilities, mastering specific concepts easily. The same findings were recorded from the study by Serin (2011), Furkan and Kutluca (2012 and Garcia and Pacheco (2013), which confirm the effectiveness of ICT in promoting pupils' attainment in mathematics and science subject areas, hence, improved school performance.

4.3.4 Multiple Linear Regression Coefficients of the Effect of World Vision ICT Infrastructure on School KCPE Mean Scores

In this study the researcher ran a multiple linear regression model to assess the effect of World Vision ICT infrastructure on public primary school KCPE mean scores. The results are shown in Table 4.7

Table 4.7: Multiple Linear Regression Coefficients of the Effect of World Vision ICT Infrastructure on School KCPE Mean Scores (z_s2tm)

Variable	Variable label	Model 1 (z_s2tm)			Model 2 (z_s2tm)			Model 3 (z_s2tm)		
		U.Coef	*p*	B	U.Coef	*P*	B	U.Coef	*p*	B
t23a3	Strongly agree: Creating & using Microsoft offices in schools	-0.972	0.004	-0.368	-1.201	0.001	-0.454	-1.528	<.001	-0.578
_Is16_1	School is WV-ICT covered				1.198	0.004	0.608	1.570	0.002	0.7959
_It11_1	Male teacher							0.467	0.185	0.2182
_It12_2	Teacher education: Diploma							-0.083	0.834	-0.036
_It12_3	Teacher education: B.Ed degree							-0.699	0.266	-0.245
_It14_1	Deputy H/Teacher							-0.326	0.552	-0.123
_It15_3	Teacher's working exp in Kkg county: 6-10 yrs							-0.504	0.184	-0.202
_It15_4	Teacher's working exp in Kkg county: 11-55 yrs							-0.106	0.776	-0.049
_It15_5	Teacher's working exp in Kkg county: 16-20 yrs							0.324	0.731	0.1032
_It15_6	Teacher's working exp in Kkg county: >20 yrs							-0.192	0.768	-0.061
Constant		0.162	0.004	n/a	-0.733	0.027	n/a	-0.996	0.064	n/a
N			36			36		36	36	
R^2			0.1351			0.3316		0.4886	0.4886	
Root Mean Squared Error (RMSE)			0.9436			0.8550		0.8636	0.8636	

Note. U.Coef=Unstandardized Coefficient; RMSE=Standard deviation of the regression model (the closer to zero better the fit)
Source: Stata output, 2019

Table 4.7 indicates the findings of the multiple linear regression coefficients of the effect of World Vision ICT infrastructure on KCPE mean scores in Matete Sub-County. During the reporting of the findings three sequential regression models were developed. In Model-1, teachers who strongly agree that creating and using Microsoft office (t23a3) improves academic performance have a negative effect on their schools mean score by up to -0.97 standard deviation below the mean (p= 0.004). This result implies that Microsoft office impacts positively on the schools' mean scores. The implication of these findings is that the results explain up to 13.51% of the variations between variables which included the correlation of creating and using Microsoft office and the school KCPE mean scores. The results conform to the findings by Becta (2001) who asserts that educational institutions use intranets to perfect their management and organisation of teaching and learning processes. This entails potential application of ICT in reporting of the development of pupils in tests and assignments and monitoring pupils' performance and also sharing of information among the teaching staff members.

Model-2 controlled for the school feeding programme and the effect of t23a3 is still significant (p=0.001). These results mean that 33.16% of the respondents affirm the fact that creating and using Microsoft office improves the schools' performance. In the final model, after controlling for school and teacher variables the effect of t23a3 on school mean scores remained significant (p<.001) at 95% confidence level. These findings explain 48.86% of the variations among the covariates in this study. In summary, the use of ICT infrastructure positively correlates with improved school performance. This is in line with the findings of Pilkington (2005) and the study by Price Waterhouse Cooper (2004) who approved the fact that ICT enhances improved administrative and teaching processes

among the educational personnel. In both studies, the findings suggested that ICT applications help to address workload issues within educational institutions. This is achieved through improved communication with learners, parents and other relevant stakeholders within the local community**.**

4.3.4 Hypothesis testing

Since _t23a3_1 = 0; F (1,24) = 20.43; Prob > F = 0.0001 is statistically significant at the 95% confidence level, the researcher rejected the null hypothesis that ICT infrastructure has no statistically significant relationship with overall school mean scores in KCPE 2008-2016.

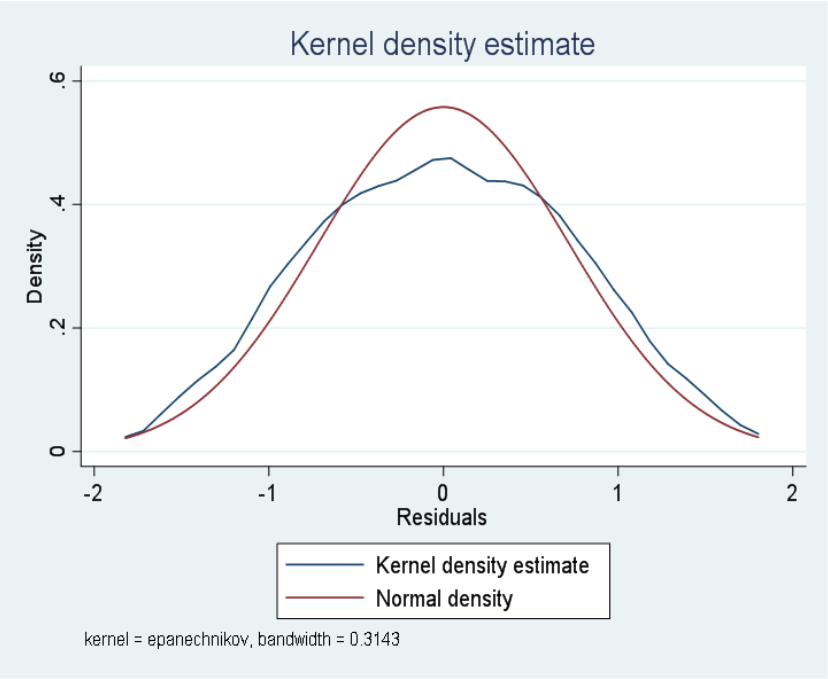
4.3.5 Post estimation diagnostics

4.3.5.1 Testing for Normality

The errors should be normally distributed - technically normality is necessary only for hypothesis tests to be valid, estimation of the coefficients only requires that the errors be identically and independently distributed.

4.3.5.2 kdensity

Figure 4.1 indicates the results of the variables after being subjected to kernel density test:



Source: Stata Output,2019

Figure 4.1: Kernel Density Estimate for Normality of residuals for Objective 1 Final Multiple Regression Model

From figure 4.1, density estimate indicates that the residuals appear to follow a normal pattern. So the model is fine (n () set to 36).

4.3.5.3 Swilk test

Shapiro-Wilk W test for normal data

Variable	Obs	W	V	z	Prob>z
kitari11	36	0.98677	0.483	-1.524	0.93620

A non-graphical test is the Shapiro-Wilk test for normality. It tests the hypothesis that the distribution is normal; in this case the null hypothesis is that the distribution of the residuals is normal. If p<.05, we reject the null and conclude that the residuals are not normally distributed. In this study, the p-value is 0.93620 (more than 0.05) and we fail to reject the null at 95% confidence level and conclude that the residuals are normally distributed.

4.3.5.4 Sktest

Skewness/Kurtosis tests for Normality

			------ joint ------		
Variable	Obs	Pr(Skewness)	Pr(Kurtosis)	adj chi2(2)	Prob>chi2
kitari11	36	0.9933	0.4117	0.70	0.7040

The p-value results of 0.7040 is more than 0.05.Therefore, the researcher failed to reject the null (at 95% confidence interval) and concluded that the residuals are normally distributed.

4.3.6 Testing for Linearity

4.3.6.1 Scatter plot

The relationships between the predictors and the outcome variable should be linear. For a quick assessment of the model the researcher ran a scatter plot and results are shown in Figure 4.2

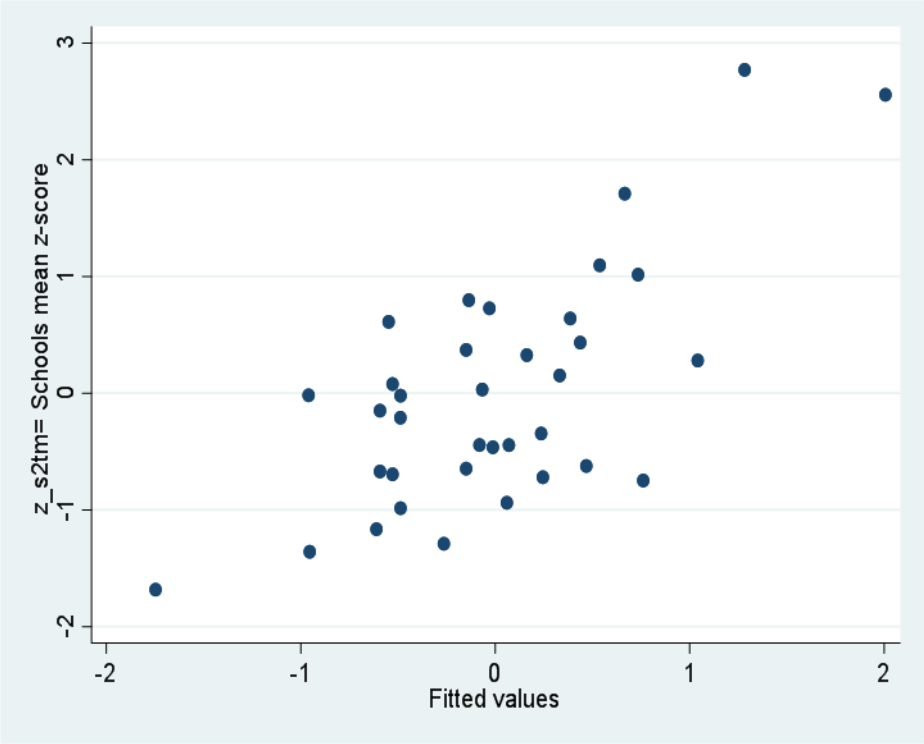


Figure 4.2: Scatter diagram for the observed data (y-axis, z_s2tm) and the predicted data, Yhat (x-axis) under Objective 1

Source: Stata Output, 2019

We should expect a 45 degree pattern in the data. Y-axis is the observed data and x-axis is the predicted data (Yhat). In this case the model does appear to be doing a good job in predicting z_s2tm

4.3.6.2 Ovtest

The null hypothesis is that the model has no omitted-variables bias, the *P*-value of F(3, 26) = 1.16; Prob > F = 0.3426 is more than the usual threshold of 0.05 (at 95% confidence interval), therefore the researcher failed to reject the null and concluded that the model does not suffer from omitted variables.

Ramsey RESET test using powers of the fitted values of z_s2tm

Ho: model has no omitted variables

F(3, 26) = 1.16

Prob > F = 0.3426

4.3.6.3 Linktest

```
      Source |       SS       df       MS       Number of obs   =        36
-------------+------------------------------   F(2, 33)        =     17.40
       Model |  17.9666698     2  8.9833349   Prob > F        =    0.0000
    Residual |  17.0333302    33  .516161521   R-squared       =    0.5133
-------------+------------------------------   Adj R-squared   =    0.4838
       Total |         35        35         1   Root MSE        =    .71844

------------------------------------------------------------------------------
      z_s2tm |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _hat |    .951512   .1777216     5.35   0.000     .5899348    1.313089
     _hatsq |   .1911374   .1475949     1.30   0.204    -.1091467    .4914215
      _cons |  -.0907958   .1387569    -0.65   0.517    -.3730989    .1915073
------------------------------------------------------------------------------
```

The researcher ran a"Linktest" command to test for the model specification after running the regress command. This was meant to check whether there was need for more variables in the model by running a new regression with the observed Y (z_s2tm) against Yhat (z_s2tm_predited or X) and Yhat-squared as independent variables. The researcher used this to look for the significance of _hatsq. The null hypothesis is that there is no specification error. If the p-value of _hatsq is not significant then we fail to reject the null and conclude that the model is correctly specified. For the case of this study, p=0.204 for hatsq. So the researcher failed to reject the null and concluded that the model was correctly specified.

4.3.7 Testing for Independence/Collinearity/Multicollinearity

Table 4.8: Multicollinearity test for the covariates under Objective 1, z_s2tm

Var.	Variable label	VIF	1/VIF
_Is16_1	School is WV-ICT covered	2.62	0.38098
_Is18_1	School has a feeding programme	2.35	0.4253
_It15_6	Teacher's working exp in Kkg county: >20 yrs	1.84	0.54464
_It15_4	Teacher's working exp in Kkg county: 11-55 yrs	1.81	0.55389
_It15_3	Teacher's working exp in Kkg county: 6-10 yrs	1.74	0.5744
_It15_5	Teacher's working exp in Kkg county: 16-20 yrs	1.7	0.58976
_It12_3	Teacher education: B.Ed degree	1.68	0.59539
_It14_1	Deputy H/Teacher	1.41	0.70789
_It11_1	Male teacher	1.35	0.73842
_It23a3_1	Strongly agree: Creating & using Microsoft offices in schools	1.35	0.73854

Source: Stata Output,2019

Condition Number 12.5416

Eigenvalues & Cond Index computed from scaled raw sscp (w/ intercept)

Det (correlation matrix) 0.3914

Table 4.8 indicates the collin command as a measure of collinearity. The condition number is a commonly used index of the global instability of the regression coefficients whereby a large condition number of 10 or more, is an indication of instability. Condition index >10 indicates a collinearity problem. Condition index >100 indicates an extreme problem. There is strong correlation in the variance proportion if two or more variables have values of 0.050. The Stata command to check for multicollinearity is vif (variance inflation factor). After running the regression, a vif > 10 or a 1/vif < 0.10 indicates trouble (Stock and Watson, 2003). In this study, with a mean VIF of 0.00, indicates lack of collinearity problems in this model.

The errors associated with one observation are not correlated with the errors of any other observation. Results in Table 4.8 shows that no variable has a vif>10; hence, there are no collinearity or multicollinearity issues in the model. Thus the model was fine.

4.4 Objective 2: To Compare the Correlation in Academic Performance of Public Primary Schools Using ICTs in Teaching and Learning and Those Which Did Not in Kakamega County.

The second objective of this study was to compare the correlation in academic performance of public primary schools using ICTs in teaching and learning and those which did not in Matete Sub-County. Multiple linear coefficients of the effect of ICT use in teaching and learning on school KCPE mean scores was run to effectively address this study objective.

This objective of the study sought to test a hypothesis that there is no statistically significant correlation in academic performance of public primary schools using ICT in teaching and those which did not. The Pearson's Product-Moment Correlation Coefficient test statistic was used to determine the difference. The correlation coefficient was fitted to model the relationship between the outcome variable, the explanatory variable and the covariates for school academic performance.

In order to fit the Pearson correlation coefficient test statistic, the study first sought to establish the relationship between the academic performances of schools where teachers incorporate ICT amongst their instructional approaches as compared to the academic performance of those schools which did not. This test statistic was considered as being relevant because the outcome variable and the covariates were categorical. The results are presented in Table 4.9

4.4.1 Correlation Matrix for Objective 2

The results of a correlation matrix between the outcome variable, the explanatory variable and the covariates for school academic performance are shown in Table 4.9.

Table 4.9: Correlation Matrix Between the Outcome Variable (z_s2tm), the Explanatory Variable (t23a3) and the Covariates for School Academic Performance, Objective 2.

Variable		z_s2tm	s41a4	s424a4	s45a2	s45a3	s49a2	s411a4
z_s2tm		1						
s41a4	a	0.339	1					
	b	0.043						
s424a4	a	0.402	0.257	1				
	b	0.015	0.131					
s45a2	a	-0.354	0.122	-0.033	1			
	b	0.034	0.478	0.851				
s45a3	a	0.428	0.081	0.172	-0.711	1		
	b	0.009	0.640	0.317	<.001			
s49a2	a	0.380	0.215	0.257	0.122	-0.065	1	
	b	0.022	0.209	0.131	0.478	0.709		
s411a4	a	0.505	0.257	0.303	-0.200	0.172	0.257	1
	b	0.002	0.131	0.072	0.243	0.317	0.131	
s412a4	a	0.332	0.226	0.365	0.124	0.036	0.226	0.365
	b	0.048	0.186	0.029	0.473	0.836	0.186	0.029
s416a4	a	0.393	0.226	0.365	-0.016	0.196	0.226	0.365
	b	0.018	0.186	0.029	0.929	0.251	0.186	0.029
s428a2	a	-0.370	-0.142	-0.070	0.337	-0.182	0.127	-0.249
	b	0.027	0.408	0.686	0.044	0.287	0.460	0.143
s428a3	a	0.337	0.178	0.092	-0.248	0.210	-0.084	0.266
	b	0.045	0.299	0.594	0.145	0.220	0.628	0.116
t31a1	a	-0.341	-0.265	-0.058	0.132	-0.238	-0.144	-0.380
	b	0.042	0.118	0.736	0.443	0.162	0.401	0.022
t31a2	a	0.341	0.265	0.058	-0.132	0.238	0.144	0.380
	b	0.042	0.118	0.736	0.443	0.162	0.401	0.022
t323a1	a	0.451	-0.284	0.197	-0.223	0.263	0.021	0.197
	b	0.006	0.094	0.249	0.191	0.122	0.903	0.249
t323a2	a	-0.451	0.284	-0.197	0.223	-0.263	-0.021	-0.197
	b	0.006	0.094	0.249	0.191	0.122	0.903	0.249
t325a3	a	0.384	0.027	0.251	-0.440	0.478	0.189	0.467
	b	0.021	0.876	0.139	0.007	0.003	0.270	0.004

Note: a=Pearson correlation coefficient; b=p-values (α=0.05); Pair-wise correlation: ≤0.35 = Weak correlation; 0.36-0.67 = Moderate correlation; 0.68-0.89=Strong correlation; ≥0.90 = Very strong correlation; Adapted from "Interpretation of correlation coefficient, " by R. Taylor, 1990, Journal of Diagnostic Medical ; Sonography, 6(1), p. 37

Source: Stata Output, 2019

Table 4.9 indicates the results of a correlation matrix for objective two. The second research objective was to compare the difference in academic performance of public primary schools using ICT in the teaching and learning processes and those which did not. The hypothesis on this objective was that there is no statistically significant difference in academic performance of public primary schools using ICT in teaching and learning and those which did not. The Pearson product- moment Correlation Coefficient results in Table 4.9 indicate that there is statistically significant correlation between the academic performances of schools using ICT in teaching as compared to those which do not. The results show that the schools making use of ICT (b) have lower p-values as compared to those schools which did not use ICT in teaching and learning processes whose p-values (a) in the model are relatively higher.

4.4.2 Multiple Regression of the Effect of ICT Use In Teaching and Learning on Academic Performance of Public Primary Schools In Matete Sub-County Between 2008 And 2016

On this objective the researcher ran a multiple linear regression model of the effect of ICT Use In Teaching and Learning on Academic Performance of Public Primary Schools In Kakamega County Between 2008 And 2016. The results are indicated in Table 4.10.

Table 4.10: Multiple Linear Regression Coefficients of the Effect of ICT use in Teaching and Learning on School KCPE Mean Scores (z_s2tm)

Variable	Variable label	Model 1 (z_s2tm)		
		U.Coef	*P*	B
_Is41a4_1	Strongly agree: Teachers use ICT for instructional purpose	0.629	0.043	-0.368
_Is424a4_1	Strongly agree: Communicate effectively with families and involving them in student learning and the school community	0.285	0.504	0.294
_Is45a2_1	Agree: Computers create awareness and raise learning opportunities	-0.159	0.660	0.100
_Is45a3_1	Strongly agree: Computers create awareness and raise learning opportunities	0.439	0.267	-0.078
_Is49a2_1	Undecided: Teachers believe ICT initiative is a health hazard	0.640	0.033	0.185
_Is411a4_1	Strongly agree: Support all students to learn what is planned for them through IT	0.429	0.448	0.299
_Is412a4_1	Strongly agree: Build on students prior knowledge experience to use IT	-0.117	0.766	0.151
_Is416a4_1	Strongly agree: Creating physical environments that engage all students in purposeful learning activities	0.016	0.963	-0.050
_Is428a2_1	Strongly agree: Display practical ICT skills in various subject content	-1.009	0.026	0.007
_It31a2_1	Strongly agree: Teachers use ICT for instructional purpose	0.143	0.577	-0.295
_It323a2_1	Strongly agree: Learn about and work with local communities to improve teacher professional practice to promote IT	-0.970	0.008	0.072
_It325a3_1	Strongly agree: Work collegially with all school staff to promote IT skills	0.000	0.999	-0.389
Constant		0.372	<.001	n/a
N			36	
R^2			0.6927	
Root Mean Squared Error (RMSE)			0.6993	

Note. U.Coef=Unstandardized Coefficient; RMSE=Standard deviation of the regression model (the closer to zero better the fit)

Source: Stata Output, 2019

In the model shown in Table 4.10, multiple linear regression coefficients of the effect of ICT use in teaching and learning on school KCPE mean scores while holding other factors constant was run to determine the correlation between the covariates. The results indicated that head teachers strongly agreeing with the statement "Teachers use ICT for instructional

purpose (_Is41a4_1)" are associated with up to .6288277 standard deviation units above the mean, p<.043. These results mean that there is a strong association between Teachers who use ICT for instructional purpose and improved performance of their schools as compared to those who did not. The findings are in agreement with those of ITG (2012), who holds that a number of comprehensive tools and learning resources are provided in Eduwave to help students track their progress, improve their performance and enjoy their learning experiences. With Eduwave, learners can access their learning materials, the like of textbooks, personalised and in rich media format, from any computer, anytime and anywhere. Students can interact with their teachers and with each other through multiple communication and collaboration tools.

For teachers, the administrative and educational tools provided on Eduwave, help teachers to better manage and utilize their time allowing for higher efficiency and more room for innovation and creativity. Eduwave provides an extensive collection of instructional design, authority and professional development tools and resources to support the role of educators. In addition to the ability to manage learning content and curricula, teachers can easily create their own teaching material. They are also able to interact with students through the systems various communication channels. Teachers are also provided with a variety of assessment and evaluation tools that help them measure individual student performance and progress (ITG, 2012).

The headteachers agreeing with the statement "Teachers believe ICT initiative is a health hazard (_Is49a2_1)" are associated with up to .6395121 standard deviation units above the mean, p<.033. This result is associated to the individual teacher's beliefs. This is because it is a new finding which is not backed by scientific evidence. So far we don't have concrete evidence to substantiate this kind of arguments.

Headteachers agreeing with the statement "Display practical ICT skills in various subject content (_Is42 8a2_1)" are associated with up to -1.008899 standard deviation units below the mean, p<.026. The learners' abilities in relation to ICT use in a classroom setting promote hands on otherwise practical manipulation of materials which positively impact on the ability to grasp and subsequently retain the learned knowledge and skills. This is in line with the findings by Becker and Ravita (2001) whose study showed that computer use among teachers is related to constructivist views and practices and to chances in practice in a more constructivist – compatible direction. Other researchers suggest that there is a relationship between teacher/child centred beliefs about instruction and the nature of teacher's technology – integrated experiences (Tottr *et al* 2006). Alongside these observation it is important to note that as the learners' engage actively in making use of computers, they may develop positivity, hence, improved self efficacy in the utilization of technology to learn.

Teachers strongly agreeing with the statement "Learn about and work with local communities to improve teacher professional practice to promote IT (_It323a2_1)" are associated with up to -.9700028 standard deviation units below the mean, p<.008. This

significant view implies that technology will be used even out of school setting. This is supported by the findings of Baver and Kenton (2005) who noted that teachers who are highly educated and skilled with technology were innovative and adapt to overcoming obstacles but they did not integrate technology on a consistent basis both as a teaching and learning tool. Results indicated that schools have not yet achieved true technology integration.

This model's constant is statistically significant, .3717451, p<.001;

The overall model is statistically significant, p<.001 and explains 69.27% of the variation in school KCPE mean scores between the years 2008-2016. Numerous studies have been conducted to identify factors facilitating or prohibiting technology integration in the classroom more so the use of computers. Some researchers focused on the availability of computers in classrooms as one of the many factors influencing the utilization of ICT in the process of teaching and learning. The final result of this model gives strength to people with open mind to embrace the use of ICT for instruction during curriculum implementation. In spite of the hitches experienced during the initial stages of ICT integration especially in public primary schools, it is worth trying.

4.4.4 Hypothesis testing

since _Is49a2_1 = 0 F(1, 22) = 5.18 Prob > F = 0.0330

_Is41a4_1 = 0 F(1, 22) = 4.60 Prob > F = 0.0433

_Is428a2_1 = 0 F(1, 22) = 5.66 Prob > F = 0.0265

_Is428a3_1 = 0 F(1, 22) = 4.52 Prob > F = 0.0449

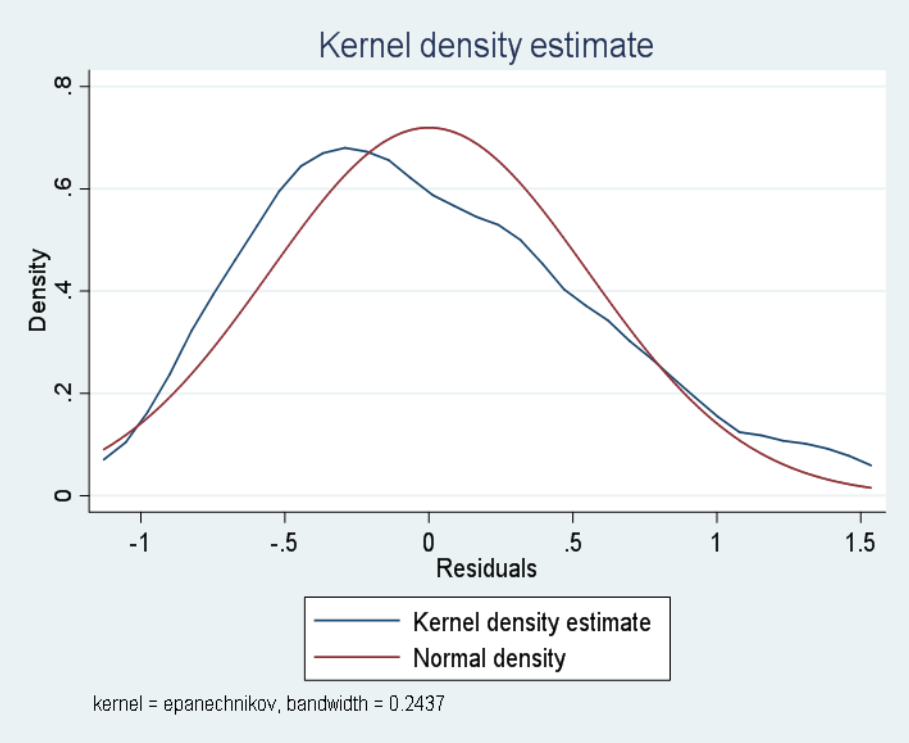
_It323a2_1 = 0 F(1, 22) = 8.48 Prob > F = 0.0081

are statistically significant at the 95% significance level, we reject the null hypothesis that the use of ICT in teaching and learning has no statistically significant relationship with overall school mean scores in KCPE 2008-2016

4.4.4.1 Testing for Normality

The errors should be normally distributed - technically normality is necessary only for hypothesis tests to be valid; estimation of the coefficients only requires that the errors be identically and independently distributed.

4.4.4.1.1 kdensity



Source: Stata Output, 2019

Figure 4.3: Kernel Density Estimate for Normality of residuals for the Objective 2 Final Multiple Regression Model

The residuals appear to follow a normally pattern. So the model is fine. (n ( ) set to 36)

4.4.4.1.2 swilk test

Shapiro-Wilk W test for normal data

Variable	Obs	W	V	z	Prob>z
kitari21	36	0.95339	1.700	1.109	0.13371

A non-graphical test is the Shapiro-Wilk test for normality. It tests the hypothesis that the distribution is normal; in this case the null hypothesis is that the distribution of the residuals is normal. If p<.05, we reject the null and conclude that the residuals are not normally distributed. In our case, the p-value is 0.13371 (more than 0.05) and we fail to reject the null (at 95% significance level) and conclude that the residuals are normally distributed

4.4.4.1.3 sktest

Skewness/Kurtosis tests for Normality

			joint	
Variable	Obs	Pr(Skewness)	Pr(Kurtosis)	adj chi2(2)	Prob>chi2
kitari21	36	0.1123	0.9812	2.72	0.2568

The p-value is 0.2568 (more than 0.05) and we fail to reject the null (at 95% confidence interval) and conclude that the residuals are normally distributed.

4.4.4.2 Testing for Linearity

Scatter Plot (z_s2tm)

The relationships between the predictors and the outcome variable should be linear.

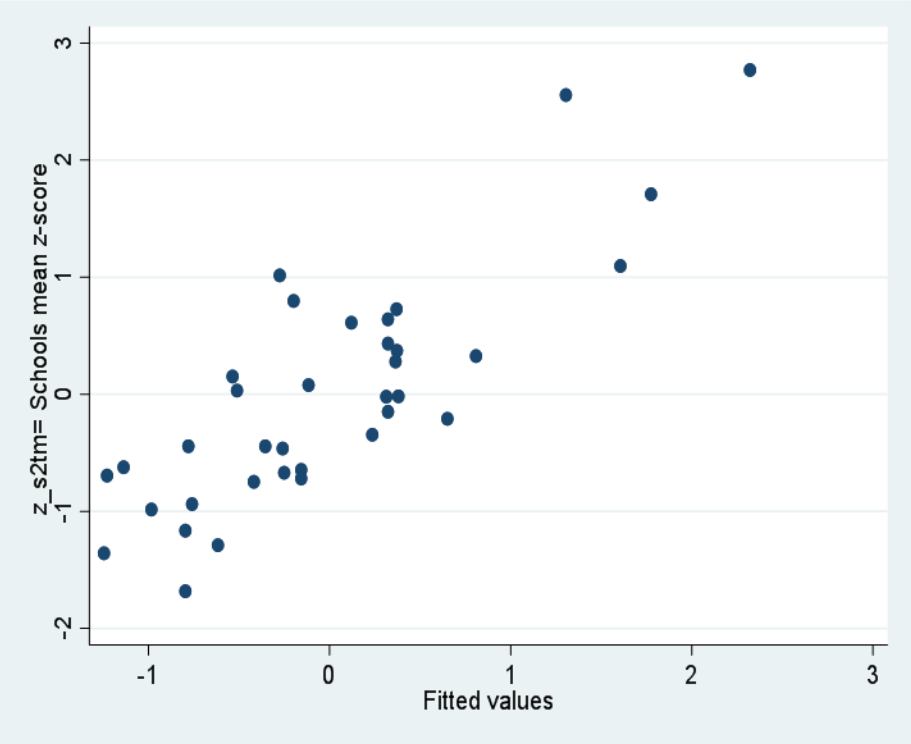


Figure 4.4: Scatter diagram for the observed data (y-axis, z_s2tm) and the predicted data, Yhat (x-axis) under Objective 2

Source: Stata Output,2019

We should expect a 45 degree pattern in the data. Y-axis is the observed data and x-axis is the predicted data (Yhat). In this case the model does appear to be doing a good job in predicting z_s2tm

4.4.4.3 Testing for Model specification

The model should be properly specified (including all relevant variables, and excluding irrelevant variables)

Table 4.11: Test of Whether the Regression Model for School KCPE Mean Scores (z_s2tm) under objective 2 is misspecified

z_s2tm	Coef.	Std. Err.	T	P>t	[95% CI]	
_hat	0.933	0.134	6.940	<.001	0.659	1.206
_hatsq	0.098	0.102	0.960	0.346	-0.110	0.305
_cons	-0.066	0.116	-0.560	0.576	-0.302	0.171

Note. n=36; Coef.=Coefficient; Std. Err=Standard Error; CI=Confidence Interval; R^2 = 0.5133; Adjusted R^2 =0.4838; Root Mean Squared Error=.71844

Source: Stata Output, 2019

The null hypothesis is that there is no specification error. If the p-value of _hatsq is not significant then we fail to reject the null and conclude that our model is correctly specified. In our case, p=0.346 for hatsq. So we fail to reject the null and conclude that our model is correctly specified.

4.4.4.3.1 Ovtest

The null hypothesis is that the model has no omitted-variables bias, the p-value F(3, 19) = 0.48; Prob > F = 0.7008 is more than the usual threshold of 0.05 (at 95% significance level), so we fail to reject the null and conclude that the model does not suffer from omitted variables

Ramsey RESET test using powers of the fitted values of z_s2tm

Ho: model has no omitted variables

F(3, 19) = 0.48

Prob > F = 0.7008

4.4.4.3.2 Linktest

The null hypothesis is that there is no specification error. If the p-value of _hatsq is not significant then we fail to reject the null and conclude that our model is correctly specified. For the case of this study, *p*=0.346 for hatsq. Therefore we fail to reject the null and conclude that the model is correctly specified.

4.4.4.4 Multicolinearity Test for Coveriates

Table 4.12: Multicollinearity test for the covariates under Objective 2, z_s2tm

Var.	Variable label	VIF	1/VIF
_Is428a2_1	Agree: Display practical ICT skills in various subject content	11.3	0.0887
_Is428a3_1	Strongly agree: Display practical ICT skills in various subject content	10.1	0.0988
_Is45a2_1	Agree: Computers create awareness and raise learning opportunities	3.69	0.2708
_Is45a3_1	Strongly agree: Computers create awareness and raise learning opportunities	3.34	0.2998
_Is411a4_1	Strongly agree: Support all students to learn what is planned for them through IT	1.95	0.5130
_It325a3_1	Strongly agree: Work collegially with all school staff to promote IT skills	1.84	0.5442
_Is412a4_1	Strongly agree: Build on students prior knowledge experience to use IT	1.78	0.5617
_It31a2_1	Strongly agree: Teachers use ICT for instructional purpose	1.72	0.5827
_Is41a4_1	Strongly agree: Teachers use ICT for instructional purpose	1.6	0.6244
_It323a2_1	Strongly agree: Learn about and work with local communities to improve teacher professional practice to promote IT	1.55	0.6449
_Is416a4_1	Strongly agree: Creating physical environments that engage all students in purposeful learning activities	1.47	0.6788
_Is424a4_1	Strongly agree: Communicate effectively with families and involving them in student learning and the school community	1.38	0.7233
_Is49a2_1	Undecided: Teachers believe ICT initiative is a health hazard	1.33	0.7518
	Mean VIF	3.31	

Note. VIF=Variance Inflation Factor; Variables should ideally have VIF<10

Source: Stata Output, 2019

The errors associated with one observation are not correlated with the errors of any other observation. From the results displayed in table 4.12, no variable has a vif>10 so we have no collinearity or multicollinearity issues. This implies that the choice and subsequent utilization of the model was correctly done.

4.5 Objective 3: To Determine the relationship between ICT Technical Support and Academic Performance of Public Primary Schools in Matete Sub-County

The third objective of this study was to determine the correlation between performance of public primary schools with and without ICT technical support in Matete Sub-County. In order to effectively address this study objective, a Pearson's Product-moment Correlation Coefficient was run to ascertain the correlation between the outcome variable (z_s2tm) and the explanatory variable while controlling for the school characteristics.

4.5.1 Correlation Matrix for Objective 3

Table 4.13: Correlation Matrix Between the Outcome Variable (z_s2tm) and the Explanatory Variable (s55a1), Objective 3.

Variable		z_s2tm	s55a1
z_s2tm		1	
s55a1	A	0.380	1
	B	0.022	

Note: a=Pearson correlation coefficient; b=p-values (α=0.05); Pair-wise correlation: ≤0.35 = Weak correlation; 0.36-0.67 = Moderate correlation; 0.68-0.89=Strong correlation; ≥0.90 = Very strong correlation; Adapted from "Interpretation of correlation coefficient, " by R. Taylor, 1990, Journal of Diagnostic Medical Sonography, 6(1), p. 37

4.5.2 Descriptive Statistics

For this objective the researcher ran a multiple linear regression regressing standardized assessment scores (z_s2tm) on head teachers perceptions of the effect of ICT technical support. The results are shown in Table 4.14:

Table 4.14: Multiple Linear Regression Coefficients of the Effect of ICT Technical Support on School KCPE Mean Scores (z_s2tm), Objective 3

Variable	Variable label	Model 1 (z_s2tm)			Model 12(z_s2tm)			Model 3 (z_s2tm)		
		U.Coef	*P*	B	U.Coef	*p*	β	U.Coef	*p*	B
_Is55a1_1	Agreeing: Regular breakdown of digital signals/network	1.355	0.027	0.380	1.199	0.005	0.336	1.163	0.008	0.326
_Is16_1	School is WV-ICT covered				0.835	0.013	0.423	0.994	0.033	0.504
_Is18_1	School has a feeding programme				0.507	0.121	0.256	0.626	0.079	0.315
_It11_1	Male teacher							0.443	0.281	0.207
_It12_2	Teacher education: Diploma							-0.013	0.977	-0.006
_It12_3	Teacher education: B,Ed. Degree							-0.054	0.920	-0.019
Constant		-0.113	0.493	n/a	-0.743	0.010	n/a	-1.168	0.041	n/a
N			36			36			36	
R^2			0.1442			0.2417			0.2810	
Root Mean Squared Error (RMSE)			0.9386			.91073			0.9315	

Note. U.Coef=Unstandardized Coefficient; RMSE=Standard deviation of the regression model (the closer to zero better the fit)

Source: Stata Output, 2019

Three sequential regression models were developed while Controlling for the school characteristics (school is WV-ICT and school has feeding programme).

In the first model, teachers who agree with the statement "Regular breakdown of digital signals/network (_Is55a1_1)" are associated with up to 1.199114 standard deviation units

above the mean, p<.005. This implied that regular breakdown of digital signals had a statistically significant correlation with learners' achievement in Matete Sub-County. This result explains up to 14.42% in variation amongst the covariates. The result conforms to the findings of the study by Tin, (2002) who postulates that most teacher training education put more emphasis on basic computer operations as opposed to involvement of advanced technical skills and specific content pedagogical applications. This has resulted to a wide gap in the manipulative skills geared towards improved utilization of ICTs in basic education. Further, the study observed that Technical experts are hired to address the need for expertise skills in the maintenance aspects of ICTs. It is assumed that shortage or lack of technological experts may negatively impact on academic performance since the tear and ware and the general maintenance services of the software and hardware in order to ensure efficient service delivery within educational institutions.

In the second model, schools on the WV-ICT programme are associated with up to .8347185 standard deviation units above the mean, p=.013. The findings are statistically significant. However, the model explains up to 24.17% of the correlations between the covariates. Thus the WV-ICT schools recorded improved performance in KCPE mean scores as compared to those public primary schools that were not covered by the World Vision ICT Project. These findings may be associated to the fact that World Vision provided technical staff to ensure efficient service delivery to some schools but not others. The model's constant is significant -.7427846, p=.010

The overall model is significant p=0.0019 and explains up 0.2417 or 24.17% of the variation in students assessment z-score (z_s2tm).This indicates that there are other factors that contribute to improved performance of public primary schools other than ICT technical support. These findings correlate with the argument by Kompf (2005) who holds that each author assumes ICT as a permanent feature in the landscape of teaching and learning. It is no longer possible nowadays to conceive education without ICT thus ICT helps to demystify the definition of education globally. While funding for research has increased in recent years, the expert group on future ICT skills requirement continues to warn of shortfalls in the output of graduates in ICT. This implies that ICT graduates transiting various levels in the socio-economic world have inadequate IT skills to enable them compete favourably in the knowledge based world. Though ICT is a vital sector of the economy, requiring highly skilled professionals, it represents only a relatively small fraction of the total employment. However, in the knowledge economy as it is now and more so as it will be in the near future, ICT competence is a prerequisite for employees in virtually every area. Furthermore, the need for a facility with ICT is not confined to the work environment, but increasingly permeates all aspects of everyday life including all chores to be undertaken by an individual in any form of social context. Therefore, it is imperative for stakeholders to hire and subsequently deploy ICT experts to help in breaching the gap between the skilled personnel as compared to the non skilled ones.

Headteachers who agree with statement "Regular breakdown of digital signals/network (_Is55a1_1)" are associated with up to 1.354846 standard deviation units above the mean, p<.027. These results are statistically significant and explain up to 28.10% variations

amongst the covariates. This means that regular network breakdown impact negatively on schools' performance since the learners are denied the opportunity to continuously access the desired information through on line within the stipulated time frame.

The overall model is statistically significant, p=.0267 and explains 14.42% of the variation in school KCPE mean scores between the years 2008 and 2016. Therefore, based on these results, ICT Technical support is important hence, educational institutions should endeavor to provide the technical personnel in order to facilitate efficient service delivery in the public primary schools.

4.5.4 Hypothesis testing

Since _Is55a1_1 = 0 F(1, 29) = 8.04 Prob > F = 0.0082
_Is16_1 = 0 F(1, 29) = 5.02 Prob > F = 0.0329

are statistically significant at the 95% significance level, the researcher rejected the null hypothesis that the use of ICT technical support has no statistically significant relationship with the overall public primary school mean scores in KCPE 2008-2016.

4.5.4 .1 Post estimation diagnostics

4.5.4 .1.1 Testing for Normality

The errors should be normally distributed. Technically, normality is necessary only for hypotheses tests to be valid; estimation of the coefficients only requires that the errors be identically and independently distributed.

4.5.4 .1.1.1 kdensity

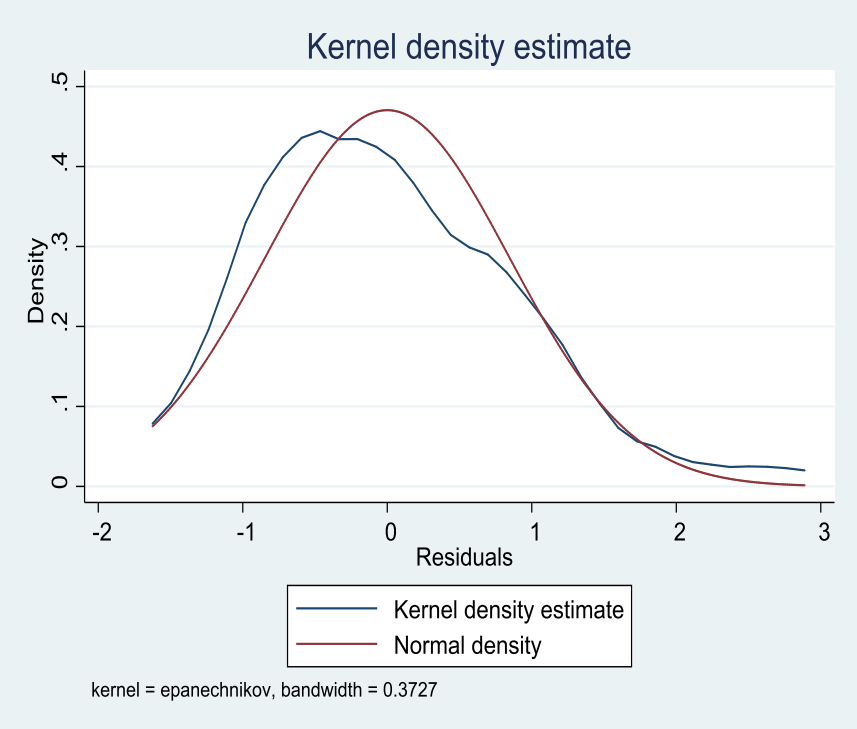


Figure 4.5: Kernel Density Estimate for Normality of residuals for the Objective 3 Final Multiple Regression Model

Source: Stata Output, 2019

The residuals appear to follow a normally pattern. So the model is fine.

(n(1) set to 36)

4.5.4 .1.1.2 S-wilk

Shapiro-Wilk W test for normal data

Variable	Obs	W	V	z	Prob>z
kitari31	36	0.94891	1.863	1.301	0.09664

The p-value is 0.09664 (more than 0.05) and the researcher failed to reject the null at 95% significance level and concluded that the residuals were normally distributed.

4.5.4 .1.3 Skewness/Kurtosis tests for Normality

Skewness/Kurtosis tests for Normality

				------ joint ------	
Variable	Obs	Pr(Skewness)	Pr(Kurtosis)	adj chi2(2)	Prob>chi2
kitari31	36	0.0443	0.2841	5.08	0.0789

The p-value is 0.0789 (more than 0.05) and we fail to reject the null at 95% significance level and conclude that the residuals are normally distributed.

4.5.4 .1.2 Testing for Linearity

The relationships between the predictors and the outcome variable should be linear.

For a quick assessment of the model the researcher ran a scatter plot. The results are indicated in Figure 4.6:

Scatter Plot (z_s2tm)

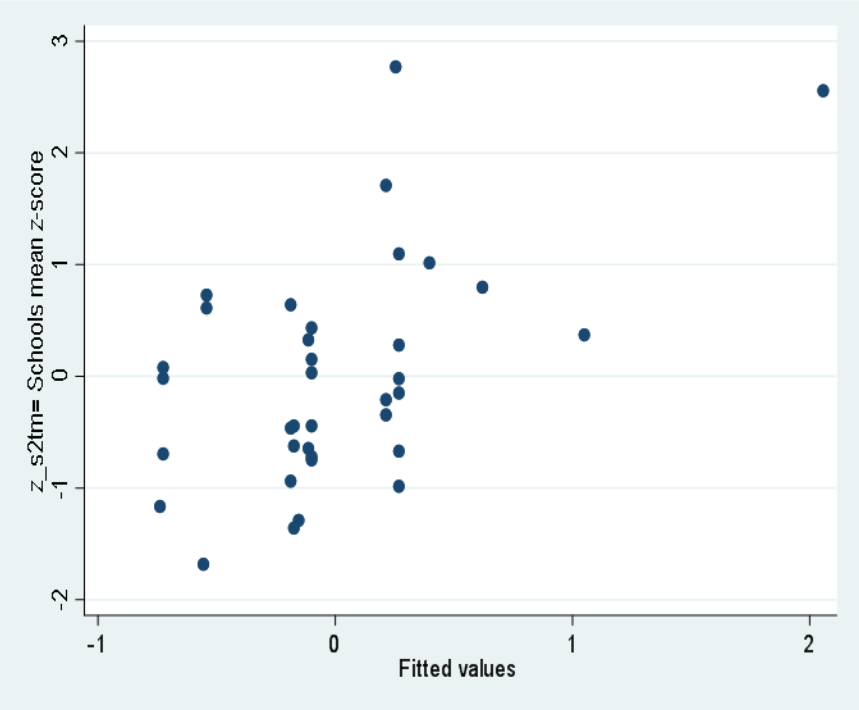


Figure 4.6: Scatter diagram for the observed data (y-axis, z_s2tm) and the predicted data, Yhat (x-axis) under Objective 3

Source: Stata Output, 2019

We should expect a 45 degree pattern in the data. Y-axis is the observed data and x-axis is the predicted data (Yhat).

In this case the model does appear to be doing a good job in predicting (z_s2tm)

4.5.4.1.3 Testing for Model specification

The model should be properly specified (including all relevant variables, and excluding irrelevant variables)

Table 4.15: Test of Whether the Regression Model for School KCPE Mean Scores (z_s2tm) under objective 3 is misspecified

z_s2tm	Coef.	Std. Err.	T	P>t	[95% CI]	
_hat	0.819	0.350	2.340	0.026	0.106	1.531
_hatsq	0.217	0.259	0.840	0.408	-0.309	0.743
_cons	-0.059	0.160	-0.370	0.714	-0.386	0.267

Note. n=36; Coef.=Coefficient; Std. Err=Standard Error; CI=Confidence Interval; R^2 = 0.5133; Adjusted R^2 =0.4838; Root Mean Squared Error=.71844

Source: Stata Output, 2019

The null hypothesis is that there is no specification error. If the p-value of _hatsq is not Significant then we fail to reject the null and conclude that our model is correctly specified. For the case of this research findings, *p*=0.408 for _hatsq. So the researcher failed to reject the null and concluded that the model was correctly specified.

4.5.4.1.4 Ovtest

The null hypothesis is that the model has no omitted-variables bias, the p-value F(3, 26) = 1.16; Prob > F = 0.3426 is more than the usual threshold of 0.05 (at 95% significance level), so the researcher failed to reject the null and concluded that the model did not suffer from omitted variables.

Ramsey RESET test using powers of the fitted values of z_s2tm

Ho: model has no omitted variables

F(3, 26) = 1.16

Prob > F = 0.3426

4.5.4.1.5 Linktest

Source	SS	df	MS	Number of obs =	36
Model	10.3604157	2	5.18020784	Prob > F =	0.0031
Residual	24.6395843	33	.74665407	R-squared =	0.2960
Total	35	35	1	Adj R-squared =	0.2533
				Root MSE =	.86409

z_s2tm	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
_hat	.8185573	.3503207	2.34	0.026	.1058245	1.53129
_hatsq	.2169929	.2587436	0.84	0.408	-.3094248	.7434107
_cons	-.059283	.1604287	-0.37	0.714	-.3856776	.2671117

The null hypothesis is that there is no specification error. If the p-value of _hatsq is not significant then we fail to reject the null and conclude that our model is correctly specified. For the case of this study, *p*=0.408 for _hatsq. The results are more than the recommended threshold of alpha = 0.05. Hence, the researcher failed to reject the null and concluded that the model was correctly specified.

4.5.4.1.5 Testing for Independence/Collinearity/Multicollinearity

The errors associated with one observation are not correlated with the errors of any other observation. In this study the researcher ran a multicollinearity test and the findings are shown in Table 4.16:

Table 4.16: Multicollinearity test for the covariates under Objective 3, z_s2tm

Var.	Variable label	VIF	1/VIF
_Is18_1	School has a feeding programme	2.34	0.42673
_Is16_1	School is WV-ICT covered	2.32	0.43038
_Is55a1_1	Undecided: Regular breakdown of digital signals/network	1.21	0.82393
_It12_3	Teacher education: B,Ed. Degree	1.21	0.82627
_It11_1	Male teacher	1.15	0.87222
_It12_2	Teacher education: Diploma	1.09	0.91528
	Mean VIF	1.55	

Note. VIF=Variance Inflation Factor; Variables should ideally have VIF<10

Source: Stata Output, 2019

The errors associated with one observation are not correlated with the errors of any other observation. Results in Table 4.16 shows that no variable has a vif>10; hence, there are no collinearity or multicollinearity issues in the model. The model fits this study well.

4.6 Objective 4: To Establish the relationship Between Teachers' Perception and the Use of ICT in Public Primary schools in Matete Sub-County

The fourth objective of this study was to establish the correlation between teachers' perceptions and the use of ICTs in public primary schools in Matete Sub-County. The data generated from this objective was analyzed using the Chi-square test statistic in which the Fisher's exact results were used to determine the associations between covariates.

In this objective, the researcher tested the null hypothesis that there is no statistically significant correlation between the teachers' perceptions and the use of ICTs in public primary schools in Matete Sub-County. Chi-Square test statistic was conducted to assess whether teachers' perceptions correlated with the use of ICT to improve the performance of school KCPE mean scores in Matete Sub-County. The results were indicated in the tables 4.17, 4.18, 4.19 and 4.20:

Table 4.17: Chi-square Association Between Gender of Teacher (t11) and their Likert Rating on Various Aspects of ICT use (t5*)

Association between Gender of teacher (t11) and their Rating that	Fisher's Exact
t52= ICT increases access to information by learners	0.633
t53= ICT has displaced teachers' work	0.102
t54= ICT increases access to pornographic literature by learners	0.391
t55= ICT causes vision disorders to learners & teachers	0.439
t56= ICT causes poor utilization of resources in school	0.281
t57= ICT increases participation in class activities by learners	0.999
t58= ICT improves social-economic development in school	0.585
t59= ICT enhances e-learning in schools	0.124
t510= ICT embraces acquisition and dissemination of ideas	0.175
t511= ICT enriches teaching, learning and research	0.644
t512= ICT causes loss of interest of certain specialization among learners	0.522
t513= ICT use forces teachers to finance ICT equipment	0.268
t514= ICT destroys school property (books, blackboards)	0.679
t515= ICT encourages teachers to embrace change in teaching approaches	0.236
t516= ICT creates opportunities of competition for success in IT promotion initiatives	0.476

Note. n=36; tab t51 t11, chi2 col row V expected / Pearson chi2(1) = 5.2800
Pr = 0.022 Cramér's V = -0.3830

Source: Stata Output, 2019

When a Chi-square test was conducted, the results indicated in Table 4.17 (Pearson chi2(1) = 5.2800 Pr = 0.022 Cramér's V = -0.3830) realized. These results revealed that there was a correlation between the teachers' gender and their perceptions on t51 "Improved performance in school mean score". Up to 16 (64.00%) of the 25 males strongly agree with the statement that ICT improves performance in school mean score compared with 11 (100%) female. The findings are statistically significant (p = 0.022). This implies that gender has an effect on learners' performance. Thus stereotypes based on gender may affect how the learner performs in a given subject area. For example, females regard mathematics related subjects to be difficult; hence, they should be done by male pupils. This may not be the truth but it is there.

Table 4.18: Chi-square Association Between Teacher Education (t12) and their Likert Rating on Various Aspects of ICT use (t5*)

Association between teacher education (t12) and their Rating that	Fisher's exact
t51= ICT Improves school mean score	0.354
t52= ICT increases access to information by learners	0.327
t53= ICT has displaced teachers' work	0.121
t54= ICT increases access to pornographic literature by learners	0.602
t55= ICT causes vision disorders to learners & teachers	0.445
t56= ICT causes poor utilization of resources in school	0.354
t57= ICT increases participation in class activities by learners	0.463
t58= ICT improves social-economic development in school	0.724
t59= ICT enhances e-learning in schools	0.770
t510= ICT embraces acquisition and dissemination of ideas	0.884
t511= ICT enriches teaching, learning and research	0.765
t512= ICT causes loss of interest of certain specialization among learners	0.805
t513= ICT use forces teachers to finance ICT equipment	0.579
t514= ICT destroys school property (books, blackboards)	0.849
t515= ICT encourages teachers to embrace change in teaching approaches	0.324
t516= ICT creates opportunities of competition for success in IT promotion initiatives	0.633

Note. n=36

Source: Stata Output, 2019

After conducting a Chi-square test statistic, the Fisher's exact results shown in Table 4.18 revealed that there is no relationship between teachers' Education and the various aspects of ICT use in public primary schools in Matete Sub-County. These results are contrary to the findings of the study by Bauer and Kenton (2005). In their study, teachers who are highly educated and skilled with technology are innovative and adopt overcoming obstacles, but the

did not integrate technology consistently as a teaching and learning tool.

Table 4.19: Chi-square Association between Teacher Experience (t15) and their Likert Rating on Various Aspects of ICT use (t5*)

Association between teacher experience (t5) and their Rating that	Fisher's exact	Cramer's V
t51= ICT Improves school mean score	0.845	
t52= ICT increases access to information by learners	0.002	``
t53= ICT has displaced teachers' work	0.446	
t54= ICT increases access to pornographic literature by learners	0.462	
t55= ICT causes vision disorders to learners & teachers	0.484	
t56= ICT causes poor utilization of resources in school	0.654	
t57= ICT increases participation in class activities by learners	0.896	
t58= ICT improves social-economic development in school	0.478	
t59= ICT enhances e-learning in schools	0.932	
t510= ICT embraces acquisition and dissemination of ideas	0.039	0.5616
t511= ICT enriches teaching, learning and research	0.067	
t512= ICT causes loss of interest of certain specialization among learners	0.046	0.4783
t513= ICT use forces teachers to finance ICT equipment	0.199	
t514= ICT destroys school property (books, blackboards)	0.853	
t515= ICT encourages teachers to embrace change in teaching approaches	0.658	
t516= ICT creates opportunities of competition for success in IT promotion initiatives	0.019	0.6860

Note. df=degrees of freedom; Cramer's V: 0-.19=weak association; .20-.49=moderate association; >.49=strong associate

Source: Stata Output,2019

Table 4.19 indicates the findings of a Chi-Square association teachers' experience and their likert rating on various aspects of ICT use in Matete Sub-County.The results displayed in table 4.19 shows that there is a relationship between the teachers experience in Matete Sub-County and their perceptions on t52 "Increased access to information by learners". Up to 23 (63.89%) teachers strongly agree with the statement that ICT

increased access to information by learners of which 10 have between 1-5 yrs of experience, p=0.002.

There is a relationship between the teachers experience in Matete Sub-County and their perceptions on t510 "Embraces acquisition and dissemination of ideas". Up to 20 (55.56%) teachers agreeing with the statement that ICT embraces acquisition and dissemination of ideas of which 8 have between 11-15 years of experience.

There is a correlation between the teachers experience in Matete Sub-County and their perceptions on t516 "Create opportunities of competition for success in IT promotion initiatives". Up to 34 (94.44%) teachers agree with the statement that ICT creates opportunities of competition for success in IT promotion initiatives of which 11 have between 11-15 years of experience. The expected frequency for that cell is 10.4. These findings conforms with the results from a survey based on a National Centre for Education Statistics (NCES, 2000) which found that 39% of teachers indicated that they used computers or the internet to create instructional materials, 34% for administrative record keeping, less than 10% reported to access model lesson plans or access research and best practices. Similarly a report released by the United States department of education indicated that novice teachers were more likely to use computers or the internet to accomplish a variety of teaching objectives (NCES, 2000). These findings contradict the feelings of experienced teachers who have taught for a period of more than 20 years. This is in line with the findings of Guha (2000) who reported that there are significant differences and positive correlations between teachers' perceptions, computer training, level of comfort and computer usage in the classroom out of prolonged exposure to technology.

Table 4.20: Chi-square Association Between Teacher ICT Training (t16) and their Likert Rating on Various Aspects of ICT use (t5*)

Association between teacher ICT training (t16) and their Rating that	Fisher's exact	Cramer's V
t51= ICT Improves school mean score	0.148	
t52= ICT increases access to information by learners	0.040	0.4010
t53= ICT has displaced teachers' work	0.999	
t54= ICT increases access to pornographic literature by learners	0.172	
t55= ICT causes vision disorders to learners & teachers	0.216	
t56= ICT causes poor utilization of resources in school	0.999	
t57= ICT increases participation in class activities by learners	0.999	
t58= ICT improves social-economic development in school	0.622	
t59= ICT enhances e-learning in schools	0.536	
t510= ICT embraces acquisition and dissemination of ideas	0.005	0.8090
t511= ICT enriches teaching, learning and research	0.027	0.5330
t512= ICT causes loss of interest of certain specialization among learners	0.051	
t513= ICT use forces teachers to finance ICT equipment	0.328	
t514= ICT destroys school property (books, blackboards)	0.321	
t515= ICT encourages teachers to embrace change in teaching approaches	0.999	
t516= ICT creates opportunities of competition for success in IT promotion initiatives	0.005	0.8044

Note. df=degrees of freedom; Cramer's V: 0-.19=weak association; .20-.49=moderate association; >.49=strong association

Source: Stata Output, 2019

Table 4.20 indicates the findings of a Chi-Square association between teachers' Training and their likert rating on various aspects of ICT use in Matete Sub-County. Table 4.20 indicates that there is a correlation between teacher-ICT training (t16) and their perceptions on t52 "Increased access to information by learners". Up to 23 (63.89%) teachers who are ICT -trained strongly agree with the statement that ICT increases access to information by learners. These results contradict the findings by Mukwa, (2015) who postulates that there are people in the society who feel that teaching and learning is already established and therefore there is no need to integrate technology in teaching. It should be integrated in fields like transport, agriculture and tourism. Other critics say

that computers as a component of ICT pose potential health problems like poor eyesight, young people accessing pornographic materials among others. Teachers' slogan, "laptops can wait, teachers cannot" which was referring to the teachers' dissatisfaction with their salary rates is proof enough to depict the negative view on the use of ICT in public primary schools in Kenya.

There is a relationship between teacher- ICT training (t16) and their perceptions on t510 "Embraces acquisition and dissemination of ideas". Up to 19 (57.58%) teachers who are ICT -trained agree with the statement that ICT embraces acquisition and dissemination of ideas. These significant results have a backing from the study by Lam & Laurence (2002) who observed that Technology not only gives learners the opportunity to control their own learning processes but also provides them with ready access to a vast amount of information over which teachers have no control.

There is a relationship between teacher- ICT training (t16) and their perceptions on t511 "Enrich teaching, learning and research". Up to 31 (93.94%) teachers who are ICT -trained strongly agree with the statement that ICT enriches teaching, learning and research. The findings are quite critical in line with the argument by Schiller (2003) who points out that personal characteristic such as educational level, age, gender, personal experience with computers and attitude towards ICT can influence the adoption of technology.

Furthermore, there is a relationship between teacher- ICT training (t16) and their perceptions on t516 "Create opportunities of competition for success in IT promotion

initiatives". All the 33 teachers who are ICT -trained agree with the statement that ICT creates opportunities of competition for success in IT promotion initiatives. These findings correlates to that of Tsikalaki & Valatidis (2010) who believe that Technological progress combined with a parallel evolution of pedagogical sciences results in the belief that integration of ICT into learning may bring about a new era in the educational practices. However, the introduction of ICT in educational practice is followed by a myriad of essential gaps and encounters multifold difficulties. All stakeholders should therefore embrace paradigm shift to the world of technology with a lot of positivity in order to match the fast growing technological changes globally.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The purpose of this research study was to establish the effect of World Vision ICT Project on performance of public primary schools in Matete Sub-County, Kenya. This section of the research study summarized the research findings in line with the objectives of the study which were: To establish the difference in academic performance of public primary schools with ICT infrastructure and those without between 2008 and 2016 in Kakamega County; to compare the academic performance of public primary schools using ICT in teaching and learning and those which did not in Matete Sub-County; to determine the correlation between ICT technical support and academic performance of public primary schools in Matete Sub-County and to establish the correlation between teachers' perceptions and the use of ICT in public primary schools in Matete Sub-County. This chapter, therefore, presents a summary of the main research findings, conclusions reached as well as recommendations of the study. Finally, the suggestions for further research are given.

5.2 Summary of the Research Findings

This study sought to analyse the effect of World Vision ICT Project on the performance of public primary schools in Matete Sub-County. This section presents a summary of key findings outlined in chapter four. The section highlighted findings on the difference in academic performance between public primary schools with ICT infrastructure and those

without between the years 2008 and 2016 in Matete Sub-County. The section also has findings on the correlation of KCPE mean scores of public primary schools that use ICT in teaching and learning and those which did not. Thirdly, this section presented key findings on the correlation between public primary schools which have ICT technical support personnel and those without. Finally, this section presented a summary of research findings on the correlation between teachers' perceptions and the use of ICT in public primary schools in Matete Sub-County.

5.2.1 The Difference in Academic Performance of Public Primary Schools With ICT Infrastructure and those Without Between 2008 and 2016 in Kakamega County.

On testing the research hypothesis that 'there is no statistically significant difference in academic performance of public primary schools with ICT infrastructure and those without,' Pearson Product-Moment correlation coefficient was conducted to establish the difference in academic performance in public primary schools with ICT infrastructure and those without. A two tailed independent t-test was conducted to compare public primary schools KCPE mean scores between dummy responses. The t-test results t (10.1131) = 3.0062, P= 0.013 indicated that there was a statistically significant correlation between ICT infrastructure and improved performance in KCPE mean scores. Therefore, the researcher rejected the null hypothesis and concluded that ICT infrastructure improved KCPE performance of public primary schools between the year 2008 and 2016 in Kakamega County.

5.2.2 The correlation of Academic Performance of public primary schools using ICT in Teaching and Learning and those which do not

In the second objective of this research study, the null hypothesis, 'there is no correlation in academic performance of public primary schools using ICT in teaching and learning and those which did not,' was tested using Pearson Product-moment Correlation Coefficient test statistic. The results from dummy responses indcated p-values with alpha less than 0.05, for example variable s41a4 had a value of p= 0.043; s424a4 had a value of p= 0.015, among others. Since the test results as shown in Table 4.13, were statistically significant at 95% significance level, the researcher rejected the null hypothesis that the use of ICT in teaching and learning had no statistically significant correlation with the KCPE mean scores between the year 2008 and 2016 in Kakamega County.

5.2.3 The Correlation Between ICT Technical Support and Academic Performance of Public Primary Schools in Kakamega County

In objective three, the researcher tested the null hypothesis that there is no statistically significant relationship between ICT technical support and academic performance of public primary schools in Kakamega County. Pearson Product-moment correlation coefficient test statistic was conducted to determine the correlation in KCPE performance between public primary schools with ICT technicians and those without in Kakamega County. The test results indicated in a correlation matrix between the outcome variable (z-s2tm) and the explanatory variable (s55al) indicated that p= 0.022. These results were statistically significant, hence, the researcher rejected the null hypothesis at 95% significance level and concluded that ICT technical support correlated with improved KCPE mean scores in Kakamega County between the years 2008 and 2016.

5.2.4 The Correlation Between Teachers' Perceptions and the Use of ICT in Public Primary Schools in Kakamega County

In the fourth research objective, the researcher tested the null hypothesis that there is no statistically significant relationship between teachers' perceptions and the use of ICT in public primary schools in Kakamega County. Chi-square test statistic was conducted from which the Fisher's exact results, Pearson Chi2(1)=5.2800, Pr=0.022, Cramer's V=0.3830 were shown. The results meant that there was a correlation between the gender of the teacher and the use of ICT in public primary schools in Kakamega County. The overall model indicated Fisher's exact results that showed existence of a correlation between specific teacher characteristic; for example, the gender of the teacher showed *p*=0.022; Teachers' experience was correlated with t52(increased access to information), *p*= 0.002; and variable t510(embraced acquisition and dissemination of ideas), *p*= 0.039. Finally, the researcher correlated teachers' ICT training (t16) and ICT use in public primary schools in Kakamega County. Variable t52 (increased access to information by learners) was correlated with variable (t16= teachers' ICT training). The results showed *p*=0.040; t510 (embraced acquisition and dissemination of ideas) was correlated with t16= teachers' ICT training and the results indicated *p*= 0.005; on correlating variable t511(enriched teaching, learning and research), the results showed *p*= 0.027; finally, variable t516 (ICT create opportunities for competition in promoting IT initiatives), results indicated *P*=0.005.All these findings were statistically significant. Therefore, the researcher rejected the null hypothesis that there is no correlation between teachers' perceptions and ICT use in public primary schools in Kakamega County.

5.3 Conclusions

The following conclusions were made from the results of the research study presented in chapter four in line with the objectives of the study.

5.3.1 The difference in academic performance of public primary schools with ICT infrastructure and those without between the years 2008 and 2016 in Kakamega County

A two tailed independent t-test was conducted to compare KCPE mean scores between dummy responses. The results indicated t(10.1131)=3.0031, p=0.013. These findings showed that there was a statistically significant correlation between ICT infrastructure and KCPE performance of public primary schools in Kakamega County.

5.3.2 The correlation of academic performance of public primary schools using ICT in teaching and learning and those which did not

The Pearson Product-moment correlation coefficient test statistic was conducted to compare the KCPE mean scores of public primary schools that use ICT in teaching and learning against those schools which did not use ICT. The results from dummy responses showed *p*-values which were lower than the 0.05 at 95% significance level. For example, variable s41a4 had a value of p=0.043; s424a4 had a value of *p*=0.015, among others.

Since the results were statistically significant, the researcher concluded that there was a correlation between academic performance of public primary schools that use ICT in teaching and learning to improve their KCPE mean scores in Kakamega County.

5.3.3 The correlation between ICT technical support and academic performance of public primary schools in Kakamega County

From objective three, the researcher conducted a Pearson Product-moment correlation coefficient test statistic to determine the correlation of KCPE performance of public primary schools that engaged ICT technical support personnel as compared to those schools which did not. The test results showed p=0.022. These findings were statistically significant at 95% significance level, hence, the researcher concluded that there was a correlation between ICT technical support and improved KCPE mean scores in Kakamega County.

5.3.4 The Correlation between Teachers' Perceptions and the Use of ICT in Public Primary Schools in Kakamega County

The researcher conducted a Chi-square test statistic to ascertain the association between specific teachers' perception and the use of ICT in public primary schools in Kakamega County. Fisher's exact results indicated Pearson Chi2 (1) =5.2800, Pr =0.022, Cramer's V=0.3830. These findings showed that there was a correlation between teachers' perceptions and ICT use in public primary schools. Therefore, the researcher concluded that there was a correlation between teachers' perceptions and the use of ICT in public primary schools in Kakamega County.

5.4 Recommendations

The following recommendations were derived from the conclusions of the study.

i) The findings on establishment of the difference in academic performance of public primary schools with ICT infrastructure and those without indicated

t(10.1131)=3.0031, *p*=0.013.These results were statistically significant. This meant that there was a correlation between ICT infrastructure and improved KCPE performance in Kakamega County. Therefore, basing on the findings, the researcher recommended that stakeholders in Education should develop more ICT infrastructure in public primary schools to promote hands on learning process. In this case, the government through the Ministry of Education should mobilize and direct more resources to improve ICT infrastructure in all public primary schools. The infrastructure should include provision of both soft and hard wares, search engines and digital divide among others.

ii) The findings on the correlation of academic performance of public primary schools using ICT in teaching and learning and those which did not, indicated that there was a statistically significant correlation (s41a4, *P*=0.043; s424a4, *P*=0.015). Based on these results, the researcher recommended improved digital content including the use of local languages to enhance effective interaction through information Communication Technologies inside and outside school.

iii) The findings on the determination of the correlation between ICT technical support and academic performance of public primary schools in Kakamega County revealed statistically significant correlation, *P*= 0.022. Following these conclusions, the researcher recommended that the Ministry of Education should provide skilled manpower in all public learning institutions. Teacher education course should incorporate technical skills that may enable educationists to manipulate ICT infrastructure for convenience purposes.

iv) The fourth objective was designed to establish the correlation between teachers' percptions and the use of ICTs in public primary schools in Kakamega County.

The findings from this objective indicated Pearson Chi2 (1) = 5.2800, Pr = 0.022, Cramer's V= -0.3830. These results meant that there was statistically significant correlation between teachers' characteristics and ICT use in public primary schools in Kakamega County. On the basis of these conclusions it was therefore recommended that teachers' perceptions should be considered while assigning them duties and responsibilities.

5.5 Suggestions for further research

i) An analysis of ICT policy framework and implementation plans in basic learning institutions in Kenya.

ii) An evaluation on the extent to which one laptop per child project succeeded in public primary schools in Kakamega county.

iii) Analysis of ICT policy framework in mitigating the current academic trends in primary schools in Kenya.

iv) An assessment on the extent to which digital content has been localized in Kenya.

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APPENDICES

APPENDIX I

DESCRIPTION OF VARIABLES USED IN THE ANALYSIS

tabstat z_s2tm, statistics(mean semean sd min max) columns(statistics)

variable | mean se(mean) sd min max

----------+----------

z_s2tm | -4.65e-16 .1666667 1 -1.681849 2.770515

. tab1 t23a3 s16 s18 t11 t12 t14 t15 s41a4 s424a4 s45a2 s45a3 s49a2 s411a4 s412a4

s416a4 s428a2 s428a3 t31a2 t

323a2 t325a3 s55a1

- tabulation of t23a3

. des z_s2tm t23a3 s16 s18 t11 t12 t14 t15 s41a4 s424a4 s45a2 s45a3 s49a2 s411a4 s412a4

s416a4 s428a2 s428a3 t

31a2 t323a2 t325a3 s55a1

storage display value

variable name type format label variable label

----

z_s2tm double %10.0g z_s2tm= Schools mean z-score

t23a3 byte %8.0g t23==5=Strongly agree

s16 byte %19.0g s16 s16= School is WV-ICT covered

s18 byte %8.0g yn s18= School has a feeding programme

t11	byte	%8.0g	t11	t11= Sex of teacher
t12	byte	%13.0g	t12	t12= Teacher education
t14	byte	%19.0g	t14	t14= Teacher's designation
t15	byte	%11.0g	t15	t15= Teacher's working exp in kkg county
s41a4	byte	%8.0g		s41==5=Strongly agree
s424a4	byte	%8.0g		s424==5=Strongly agree
s45a2	byte	%8.0g		s45==4=Agree
s45a3	byte	%8.0g		s45==5=Strongly agree
s49a2	byte	%8.0g		s49==3=Undecided
s411a4	byte	%8.0g		s411==5=Strongly agree
s412a4	byte	%8.0g		s412==5=Strongly agree
s416a4	byte	%8.0g		s416==5=Strongly agree
s428a2	byte	%8.0g		s428==4=Agree
s428a3	byte	%8.0g		s428==5=Strongly agree
t31a2	byte	%8.0g		t31==5=Strongly agree
t323a2	byte	%8.0g		t323==5=Strongly agree
t325a3	byte	%8.0g		t325==5=Strongly agree
s55a1	byte	%8.0g		s55==3=Undecide

APPENDIX II

LETTER TO RESPONDENTS

Dear Respondent,

I hereby write to inform all my potential respondents that I am a Doctor of Philosophy Student in the Department of Educational Planning and Management (EPM) at Masinde Muliro University of Science and Technology.

I humbly request for your kind assistance in my research work by filling in the Questionnaire objectively. Please note that the information you provide will be treated with confidentiality. Do not indicate your name in the questionnaire.

Thank you very much for your co-operation.

Yours Faithfully,

Jacob Wambasi Kitari

EPS/H/01/15

APPENDIX III
QUESTIONNAIRE FOR HEAD TEACHERS

As a head teacher in Kakamega County you have been identified as a respondent in the study: T**he effect of world Vision ICT Project on academic achievement of primary schools in Kakamega County**. Kindly spare a few minutes and respond to the questions appropriately. Your responses will be treated in confidence and will be used for academic purposes only.

Part- A: Background information

Please tick (√**)** appropriately in the spaces provided.

1. Gender of the person completing the questionnaire is:

   Male [ ] Female [ ].

2. Professional qualifications

   P1 [ ] Diploma [ ] Degree in Education [ ] Masters [ ]

   Others (please specify)

3. Working experience in Kakamega County

   Less than one year [ ]; 1 to 5 years [ ]; 6 to 10 years [ ]; 11 to 15 years [ ]

   16 to 20 years [ ]; above 20 years [ ].

4. Have you trained in ICT? Yes [ ] No [ ]

5. Is your school covered by World Vision ICT- Project? Yes [ ] No [ ]

6. Kindly indicate teacher/pupil ratio in your school

   1:30 [ ] 1:40 [ ] 1:50 [ ] 1:60 [ ] 1:70 [ ] 1:80 and above [ ]

7. Does your school have a feeding programme for the learners?

   Yes [ ] No [ ]

8. How many pupils share a text book in class?

   1:1 [ ] 1:2 [ ] 1:3 [ ] 1: 4 [ ] 1:5 [ ]

SECTION–B: KCPE SCORES

1. Kindly fill the table below with appropriate mean scores:

SUBJECT	**MEAN SCORE PER YEAR**											
	2005	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
MATHS ENGLISH KISWAHILI SCIENCE SSR												
TOTAL **MEAN**												

SECTION-C

ICT INFRASTRUCTURE

On the scale provided **Strongly Disagree(1), Disagree(2), Undecided(3), Agree(4), Strongly Agree(5),** kindly indicate in the space provided the effect of ICT infrastructure on academic achievement in public primary schools

Statement	1	2	**3**	**4**	**5**
1. Increased expenses on ICT infrastructure					
2. Increased use of software in teaching/learning					
3. Creating & using Microsoft offices in schools					
4. Use of search engines like Google					
5.Computers are installed to electronic encyclopedia					
6. using hardware in teaching/learning process					
8. usage of animations like slides, films, videos, projectors etc.					
9. Internet connectivity					
11. Use of digital content					
12. Using solar panels					
13. There is need for training in handling various ICT tools					

Other professional effects of ICT on content delivery

_____

_____

_____

SECTION-D

USE OF ICT IN TEACHING AND LEARNING

The following are ways teachers use ICT in teaching and learning process. Please respond on the scale: **Strongly Disagree(1), Disagree(2), Undecided(3), Agree(4), Strongly Agree(5),** as your experiences in using ICT while teaching and learning in public primary schools.

USE OF ICT IN TEACHING/LEARNING	**1**	**2**	**3**	**4**	**5**
Teachers use ICT for instructional purpose					
Use of ICT increase quality in academic work					
ICT makes it easier to prepare assignments for learners					
ICT make teachers more productive					
Computers create awareness and raise learning opportunities					
ICT infrastructure increase learners' interest in learning					
ICT tools improve learning environment					
ICT use reduce job opportunities for teachers					
Teachers believe ICT initiative is a health hazard					
ICT use make teachers to be lazy					
Support all students to learn what is planned for them through IT					
Build on students prior knowledge experience to use IT					
Promote talent by use of a variety of strategically selected instructional strategies and resources					
Engage all students in problem solving and critical thinking					
Teach concepts and skills in ways that encourage students to apply them in real-life to promote technology					

Creating physical environments that engage all students in purposeful learning activities					
Encourage constructive interactions among students					
Maintain safe learning environments in which all students are treated fairly and respectfully					
Encourage all students to participate in working independently using ICT tools					
Organize curriculum to facilitate students' understanding of concepts and skills in ICT					
Adjust instructional plans according to student engagement and achievement.					
Participate in the extended professional activities like attending conferences, seminars and workshops on IT					
Learn about and work with local communities to improve teacher professional practice to promote IT					
Communicate effectively with families and involving them in student learning and the school community					
Work collegially with all school staff to promote IT skills					
Publish teaching and learning materials to promote ICT					
Serve as role models to promote ICT					
Display practical ICT skills in various subject content					

SECTION-E

ICT TECHNICAL SUPPORT.

Indicate the extent to which the following technical support factors affect integration of ICT in teaching and learning in public primary schools. Please respond on the scale: **Strongly Disagree(1), Disagree(2), Undecided(3), Agree(4), Strongly Agree(5),** as your experiences in using ICT while teaching and learning in public primary schools.

ITEM	**1**	**2**	**3**	**4**	**5**
Lack of technicians to help teachers with skills to manipulate computer hardware and software					
High cost of computer maintenance services					
High cost of training staff on computer maintenance services					
Fear of computer breakdown during teaching and learning process					
Regular breakdown of digital signals/network					
ICT infrastructure are perceived to be delicate/fragile					
There is need for training in handling various ICT tools					

SECTION-F

TEACHERS' PERCEPTIONS AND THE USE OF ICT

The following are some of the perceived effects of ICT infrastructure on the teaching process. Please respond on the scale: **Strongly Disagree(1), Disagree(2), Undecided(3), Agree(4), Strongly Agree(5),** as your experiences on the effects they may have had on academic achievement in public primary schools

Effects	**1**	**2**	**3**	**4**	**5**
Improved performance in school mean score					
Increased access to information by learners					
Displaced teachers' work					
Access to pornographic literature by learners					
Cause vision disorders to learners & teachers					
Cause poor utilization of resources in school					
Increased participation in class activities by learners					
Improves social-economic development in school					
Enhances e-learning in schools					
Embraces acquisition and dissemination of ideas					
Enrich teaching, learning and research					
Loss of interest of certain specialization among learners					
Forced teachers to finance ICT equipment					
Destroyed school property (books, blackboards)					
Encourage teachers to embrace change in teaching approaches					
Create opportunities of competition for success in IT promotion initiatives					

Please make any other suggestions required to enhance the application of ICT in schools to realize change in performance of public primary schools.

_____

_____

_____

_____

_____

_____

Thanks for your responses!

APPENDIX IV
QUESTIONNAIRE FOR TEACHERS

You have been selected as a respondent in the study 'T**he effect of world Vision ICT Project on academic achievement of primary schools in Kakamega County**.' Information obtained in the study is hoped to be of great importance to stakeholders and policy makers in promoting technological skills in basic education in the region and beyond. Kindly spare a few minutes to respond to this questionnaire. Your sincere responses will be highly appreciated and treated in confidence. Please do not indicate your name anywhere in this questionnaire.

Part- A: Background information

Please tick (√**)** appropriately in the spaces provided.

1. Gender of the person completing the questionnaire is:

   Male [ ] Female [ ]

2. Professional qualifications

   P1 [ ] Diploma [ ] Degree in Education [ ] Masters [ ]

   Others (please specify)

   _____

3. Level of teaching

   Pre- school [ ] Primary [ ]

4. Designation

   Deputy [ ] Assistant teacher [ ]

5. Working experience in Kakamega County

   Less than one year [ ] 1 to 5 years [ ] 6 to 10 years [ ] 11 to 15 years [ ]

   16 to 20 years [ ] Above 20 years [ ]

6. Have you trained in ICT? Yes [ ] No [ ]

7. Is your school covered by World Vision ICT- Project? Yes [ ] No [ ]

SECTION-B

ICT INFRASTRUCTURE

On the scale provided **Strongly Disagree(1), Disagree(2), Undecided(3), Agree(4), Strongly Agree(5),** kindly indicate in the space provided the effect of ICT infrastructure on academic achievement in public primary schools

Statement	1	2	**3**	**4**	**5**
1. Increased expenses on ICT infrastructure					
2. Increased use of software in teaching/learning					
3. Creating & using Microsoft offices in schools					
4. Use of search engines like Google					
5.Computers are installed to electronic encyclopedia					
6. using hardware in teaching/learning process					
8. usage of animations like slides, films, videos, projectors etc.					
9. Internet connectivity					
11. Use of digital content					
12. Using solar panels					
13. There is need for training in handling various ICT tools					

Other professional effects of ICT on content delivery

_____

_____

_____

SECTION-C

USE OF ICT IN TEACHING AND LEARNING

The following are ways teachers use ICT in teaching and learning process. Please respond on the scale: **Strongly Disagree(1), Disagree(2), Undecided(3), Agree(4), Strongly Agree(5),** as your experiences in using ICT while teaching and learning in public primary schools.

ITEMS	**1**	**2**	**3**	**4**	**5**
Teachers use ICT for instructional purpose					
Use of ICT increase quality in academic work					
ICT makes it easier to prepare assignments for learners					
ICT make teachers more productive					
Computers create awareness and raise learning opportunities					
ICT infrastructure increase learners' interest in learning					
ICT tools improve learning environment					
ICT use reduce job opportunities for teachers					
Teachers believe ICT initiative is a health hazard					
ICT use make teachers to be lazy					
Support all students to learn what is planned for them through IT					
Build on students prior knowledge experience to use IT					
Promote talent by use of a variety of strategically selected instructional strategies and resources					
Engage all students in problem solving and critical thinking					
Teach concepts and skills in ways that encourage students to apply them in real-life to promote technology					

Creating physical environments that engage all students in purposeful learning activities					
Encourage constructive interactions among students					
Maintain safe learning environments in which all students are treated fairly and respectfully					
Encourage all students to participate in working independently using ICT tools					
Organize curriculum to facilitate students' understanding of concepts and skills in ICT					
Adjust instructional plans according to student engagement and achievement.					
Participate in the extended professional activities like attending conferences, seminars and workshops on IT					
Learn about and work with local communities to improve teacher professional practice to promote IT					
Communicate effectively with families and involving them in student learning and the school community					
Work collegially with all school staff to promote IT skills					
Publish teaching and learning materials to promote ICT					
Serve as role models to promote ICT					
Display practical ICT skills in various subject content					

SECTION-D

ICT TECHNICAL SUPPORT

Indicate the extent to which the following technical factors affect integration of ICT in teaching and learning in public primary schools. Please respond on the scale: **Strongly Disagree(1), Disagree(2), Undecided(3), Agree(4), Strongly Agree(5),** as your experiences in using ICT while teaching and learning in public primary schools.

ITEM	**1**	**2**	**3**	**4**	**5**
Lack of technicians to help teachers with skills to manipulate computer hardware and software					
High cost of computer maintenance services					
High cost of training staff on computer maintenance services					
Fear of computer breakdown during teaching and learning process					
Regular breakdown of digital signals/network					
ICT infrastructure are perceived to be delicate/fragile					
There is need for training in handling various ICT tools					

SECTION-E

TEACHERS' PERCEPTIONS AND THE USE OF ICT

The following are some of the perceived effects of ICT use on the teaching process. Please respond on the scale: **Strongly Disagree(1), Disagree(2), Undecided(3), Agree(4), Strongly Agree(5),** as your experiences on the effects they may have had on academic achievement in public primary schools

Effects	**1**	**2**	**3**	**4**	**5**
Improved performance in school mean score					
Increased access to information by learners					
Displaced teachers' work					
Access to pornographic literature by learners					
Cause vision disorders to learners & teachers					
Cause poor utilization of resources in school					
Increased participation in class activities by learners					
Improves social-economic development in school					
Enhances e-learning in schools					
Embraces acquisition and dissemination of ideas					
Enrich teaching, learning and research					
Loss of interest of certain specialization among learners					
Forced teachers to finance ICT equipment					
Destroyed school property (books, blackboards)					
Encourage teachers to embrace change in teaching approaches					
Create opportunities of competition for success in IT promotion initiatives					

Please recommend any other perceptions that may be required to enhance prudent application of ICT in schools to enhance change in performance of public primary schools.

_____

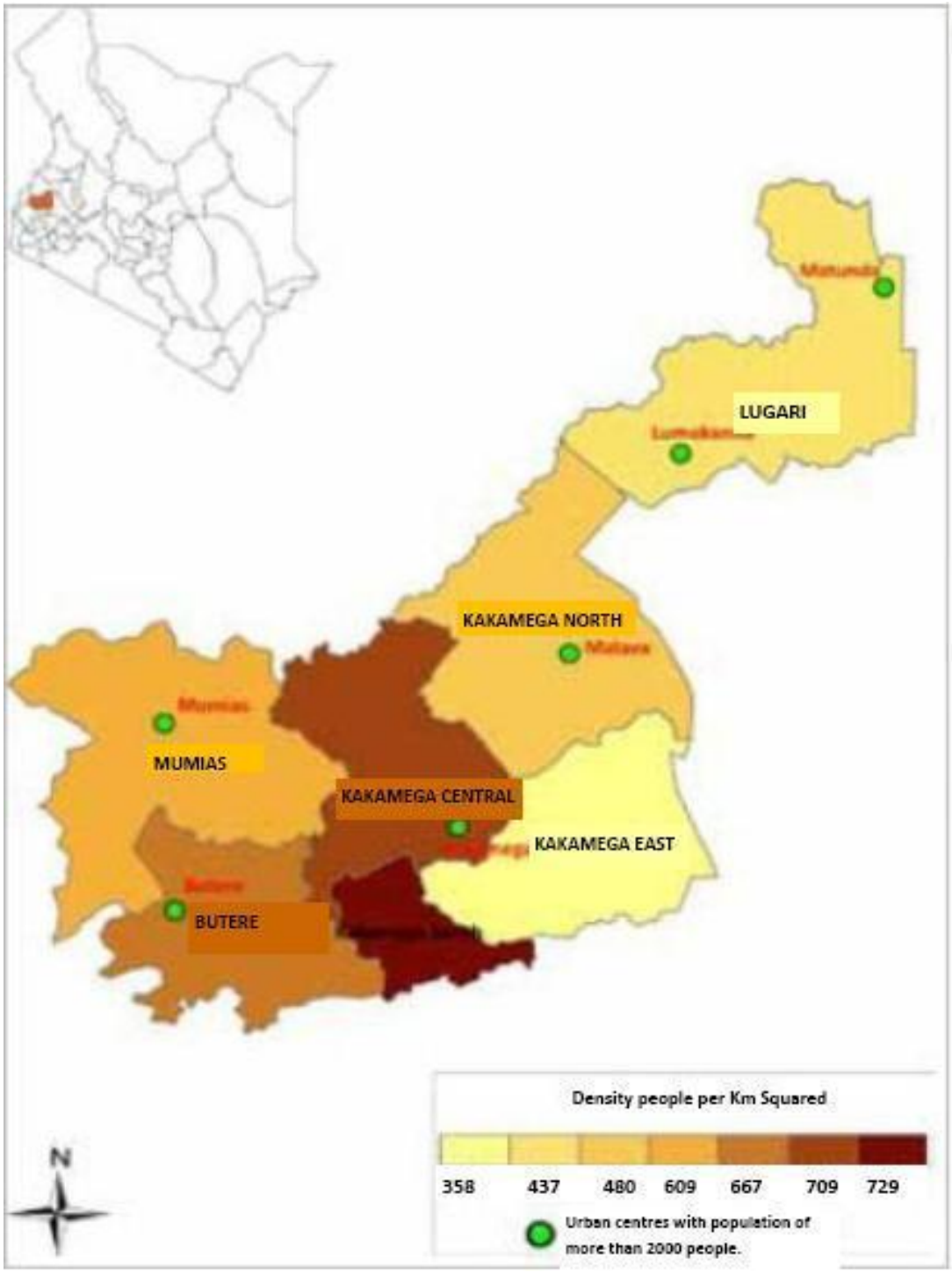
_____

_____

_____

Thanks for your responses!

APPENDIX V: MAP SHOWING STUDY AREA



APPENDIX VI: RESEARCH PERMIT

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: **583266**

Date of Issue: **19/August/2019**

RESEARCH LICENSE

This is to Certify that Mr.. JACOB KITARI of Masinde Muliro University of Science and Technology, has been licensed to conduct research in Kakamega on the topic: THE EFFECT OF WORLD VISION INFORMATION COMMUNICATION TECHNOLOGY PROJECT ON ACADEMIC PERFOMANCE OF PRIMARY SCHOOLS IN KAKAMEGA COUNTY,KENYA for the period ending : 19/August/2020.

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