INFLUENCE OF ICT ON STUDENTS' ACADEMIC ACHIEVEMENT IN THE TEACHING AND LEARNING OF MATHEMATICS IN SECONDARY SCHOOLS IN DADAAB SUB COUNTY, GARISSA COUNTY, KENYA

JOEL SILLA MUEMA

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DECLARATION

This project is my original work and has not been presented for any award of a Master's degree in any other university.

Signature ……..

Date…….

Joel Silla Muema

E55-6647-2015

This research project report has been submitted for examination with approval as the university supervisors

Dr. David M. Mulwa

Department of Education Management and Curriculum Studies

Signature **…….** Date…….

Dr. Stephen Mailu

Scholl of Pure and applied Sciences

Signature……... Date……..

DEDICATION

This work is dedicated to my sons Collins Muthama, Ian Manthi, my dear wife Mirriam Nthenya and my beloved mum Sherrina Mumbua.

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This project work was successful because of the assistance and cooperation of so many personalities. I thank the almighty God, the giver of wisdom for giving me the ability and divine provision that enabled me to complete my studies. I glorify His name forever.

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ABBREVIATIONS AND ACRONYMS

ASEI: Activity, Student, Experimental and Improvisation

CEMASTEA: Centre for Mathematics, Science and Technology in Africa

CFSK: Computers for Schools-Kenya

ESP: Economic Stimulus Program

IAEEA: International Association Evaluation of Education Achievement

ICT: Information Communication and Technology

KCSE: Kenya Certificate of Secondary School

KESSP Kenya Education Sector Support Program

MOEST: Ministry of Education Science and Technology

NACOSTI: National Commission for Science Technology and Innovation

NGO: Non-Governmental Organization

NICE: Network Initiative for Computers in Schools

PDSI: Plan, Do, See and Improve

PISA Programme for International Student Assessment

SITES: Second Information Technology in Education Study

SMASSE Strengthening Mathematics and Science subjects in secondary Education

SPSS Statistical Package for Social Sciences

TEL: Technology Enlarged Learning

UNESCO: United Nations Educational scientific and cultural organisations.

UNHCR: United Nations High Commissioner for Refuge

ABSTRACT

Mathematics is a cluster subject that acts as a determinant to the enrolment into a multitude of career courses in Kenya and other countries around the world. This explains why concerted efforts are being made by the government and other stakeholders in education to improve students' achievement in the subject. This study aimed at establishing the influence of information and communication technology on students' academic performance in mathematics in public secondary schools in Dadaab sub-county Garissa County. The specific objectives of the study were: to establish the influence of teaching method on student's achievement in mathematics, to determine the influence of teachers attitude towards ICT on students' achievement in mathematics, to establish the influence of the availability of ICT equipment on the students' achievement in mathematics and to establish the influence of teachers' competence on ICT on students' achievement in mathematics. The study was based on a conceptual model developed by Shavelson; McDonwell and Oakes (1987). The study adopted quasi experimental research design but with mixed approaches of data collection. The study targeted head teachers, mathematics teachers and students in all public secondary schools in Dadaab sub-county, Garissa County. 30% of the students' constituted the study sample. Purposive sampling was used for the principals and mathematics teachers. Achievement tests, structured questionnaires, and interview guides were used to collect both qualitative and quantitative data from respondents. Pre-testing was conducted to determine the validity of the instruments. Reliability was assessed through test-retest technique. Pearson's product moment correlation coefficient was computed to determine reliability. Qualitative data was thematically coded and quantized before entering into SPSS program, along with the quantitative data. Data was then analyzed descriptively and inferentially. Descriptive statistics involved determining the means, modes and standard deviations while inferential statistics involved the determination of Pearson correlation coefficient, T-tests for independent samples and chi-square of independence. The analyzed data was then presented using tables, charts and graphs. The study established positive correlations between teaching methods and student achievement in mathematics implied that ICT was a better determinant of student achievement compared to traditional methods. The Chi square analysis established no asymptotic relationship between teachers' attitudes towards ICT and students' achievement in mathematics. Similarly, teachers' perceptions towards ICT were not associated to academic achievement in mathematics.

Significant relationship was observed between students' achievement in mathematics and availability of ICT.

CHAPTER ONE

INTRODUCTION

1.0 Introduction

This chapter deals with the background of the study, statement of the problem, objectives of the study, research questions, hypotheses, significance of the study, limitations, scope and delimitations, theoretical frame work and conceptual framework.

1.1 Background Information

Education is a fundamental human right. It is the means by which individuals are equipped with knowledge, skills and values that enable them to become productive citizens (Wolfenson, 2011). According to the framework for action in Dakar April 2000, Education occupies a central place in Human rights and is essential and indispensable for the exercise of all other human rights and for development. Education is viewed as the root source of human, social, cultural, and economic progress (Martinez & Guzman, 2013).

As the pace of technological change in the world increases dramatically, there is need for technology to take its place in the education so as to help learners cope with the demands of 21st century. ICT is used as an umbrella term that includes any communication devices or applications, encompassing: radio, television, cellular phones, cameras, computer hardware and software, satellite systems, as

well as the various services and applications associated with them, such as video-conferencing and distance learning (Aypay, 2010). ICT has extensively been integrated into the education systems of many countries around the world. The Philippines, Indonesia, Malaysia, Uzbekistan and Vietnam have formulated policies for ICT use to make learning interactive and easier among students and teachers. In Canada, school principals and teachers use ICT resources for educational purposes such as activities directed towards lesson preparation, execution and evaluation (Luu & Freeman, 2011).

The development of ICT use in education settings has not only become a policy priority in most countries but also triggered a flurry of research studies that focus on the relationship between ICT and academic achievement. A number of studies found that computer availability and use had positive effects on students' achievement (Luu & Freeman, 2011; Kubiatko & Vlckova, 2010). The studies highlighted that it was critical to develop teacher skills in using computers and advanced communication technology in order to improve student learning outcomes (Lee &Kissinger, 2009). Other researchers however, found negative correlations between computer use and students' achievement. Wittwer and Senkbeil (2008) found that computers had no substantial influence on mathematics performance. These mixed findings could be due to the fact that the relationship between ICT use and learning achievement is mediated by other backgrounds and process-related variables (Song &Kang, 2012). Therefore, some researchers have

suggested further exploring the relationships between ICT use and learning achievement but taking other relevant variables into account, such as the purpose of ICT use given that different uses affect students' achievement in different ways (Luu &Freeman, 2011). Meta-analytic studies about the relationship between ICT's and students' achievement in comparison with traditional instruction have also shown that ICT's have a positive impact on pupils' achievement level (Liao, 2007).

In Kenya, the Ministry of Education developed a Kenya Education Sector Support Program (KESSP) in 2005 that featured ICT as one of the priority areas with the aim of mainstreaming ICTs into the teaching and learning process. The National ICT Policy embedded this intent as a national priority and provided the impetus for the ministry to develop its sector policy on ICT in Education. The need to integrate ICT in the teaching and learning of mathematics was particularly prompted by the general low performance in national examinations over the years. The trend in performance of mathematics in Kenya Certificate of Secondary Education (KCSE) for the last five years is as summarized by table 1.1

Table 1.1: Candidates' Overall Performance in Mathematics (2013-2017)

Year	Candidature	Mean Score	Maximum expected
2013	436,349	2.51	12
2014	483,630	3.31	12
2015	522,870	3.88	12
2016	574,125	3.74	12
2017	577,253	2. 83	12

Source: Kenya National Examination Council (KNEC) - KCSE Essential statistics 2018

Table 1.1 reveals that overall performance in mathematics at KCSE in the National level has been consistently been low over the last five years. In Dadaab sub-County, student's performance in mathematics over the same period (2014-2017) has been on the decline as depicted by Table 1.2

Table 1.2: Mean Performance in Mathematics for Dadaab Sub County (2014-2017)

Year	Mean Score	Maximum Expected
2014	3.3145	12.0
2015	3.0987	12.0
2016	2.5629	12.0
2017	2.2315	12.0

Source: Sub-County Director of Education – Dadaab Sub County

The dismal performance of students in mathematics is a source of concern to all education stakeholders. Aremu (2000) stresses that, academic failure is not only frustrating to the students and parents, but its effects are equally heavy on them in terms of lack of manpower in the spheres of the economy and politics. Faced with this harsh reality, the Kenyan Government developed the strategy of integration of ICTs in the teaching and learning of mathematics and science subjects. However, since their introduction, studies to assess causal relationships between their use in teaching and student performance in mathematics have been scarce and scanty. Recent studies by Song and Kang (2012); Wainer *et al*. (2008); Luu and Freeman (2011) and Spiezia (2010) to evaluate influence of ICT's on academic achievement have produced consistent results. Furthermore, most of the studies were conducted outside Dadaab Sub-County hence there is need for similar studies in the area. This study therefore aimed at investigating how the use of ICT in teaching and learning influenced students' achievement in mathematics in public secondary schools in Dadaab sub-county Garissa.

1.2 Statement of the Problem

Globally, mathematics is performed dismally compared to other subjects. In an attempt to address this, Information Communication Technologies (ICTs) have been introduced into the teaching-learning process in many countries over the world. The Kenyan government has particularly invested a lot on ICT in the education sector in a bid to promote the understanding of abstract concepts and

improve student's academic achievement. In Dadaab Sub County, most schools embraced use of ICT to support teaching and learning across a wide range of subject areas but students still register dismal academic achievement in mathematics. This study therefore aimed at investigating the influence of use of ICT on students' academic achievement in mathematics in public secondary schools in Dadaab Sub-County.

1.3 Purpose of the Study

The purpose of the study was to investigate influence of the use of ICT on students' academic achievement in the teaching and learning of mathematics in secondary schools in Dadaab Sub County - Garissa County.

1.4 Objectives of the Study

i) To establish the influence of teaching methods on students' achievement in mathematics in public secondary schools in Dadaab Sub County.

ii) To determine the influence of teachers' attitude towards ICT on students' achievement in mathematics in public secondary schools in Dadaab Sub County.

iii) To establish the influence of the availability of ICT equipment and students' achievement in mathematics in public secondary schools in Dadaab Sub County.

iv) To establish the relationship between teacher competence on ICT and students' achievement in mathematics in public secondary schools in Dadaab Sub County

1.5 Research Hypotheses

The following hypotheses were tested at 5% level of significance

H_{o1}: There is no significant relationship between the method of teaching and students' achievement in mathematics in public secondary schools in Dadaab Sub County.

H_{o2}: There is no relationship between teachers' attitude towards ICT and the students' achievement in mathematics in public secondary schools in Dadaab Sub County in Garissa County.

H_{o3}: There is no significant relationship between the availability of ICT equipment and students' achievement in mathematics in public secondary schools in Dadaab Sub County

H_{o4}: There is no significant relationship between teachers competence in ICT and students' achievement in mathematics in public secondary schools in Dadaab Sub County

1.6 Limitations

The following were the limitations of this proposed study:

1. Teaching and learning of the two groups (experimental and control) in the learning centers happened simultaneously. This posed a challenge which

the researcher had to overcome by making use of manageable number of students per group.

2. Inadequate ICT equipments in learning centres to some extend affected the research but the concentration of the study in few centres solved the problem.
3. The students were not in a position to classify ICT equipments available and access them frequently for use during the one-month teaching-learning process. This prompted the researcher to carry out in-depth explanations on the types of ICT equipments available and requested UNHCR and other NGO's operating in the Dadaab region to assist by providing access to some facilities like computer laboratories and internet.
4. Insecurity in most of the parts of Dadaab sub-county made it difficult to access some schools and centres hence the researcher sought for police escorts to help move in the region.

1.7 Delimitations

The research was conducted in two established learning centres within Dadaab sub-county in Towfiq and Ifo secondary schools which had adequate ICT facilities. The responses strictly were drawn from the school principals, mathematics teachers and students from public secondary schools in the sub-county. The study was delimited to three topics that were deemed problematic to

students due to their abstractness. These were: Surface area of solids, similarity and enlargement and Rotation.

1.8 Significance of the Study

The findings of the study will be useful to the mathematics teachers because it will provide valuable knowledge that can be used to improve student's achievement in mathematics. They will particularly be compelled to re-think of their approach and methodology of teaching mathematics as pertains to the use of ICT tools in the teaching learning process. The study also suggested significant policy statements, through its recommendations, on how ICT's can be used to optimize student performance in mathematics. The recommendations from the study will also help the school administrations, board of management and NGO's assisting in education sector in the sub-county to prioritize and avail the necessary ICT resources to improve the academic performance in their schools. The ministry of education will also find the study useful as it plans to introduce the use of laptops in all primary schools in Kenya. They will particularly be informed on the availability of ICT resources in schools; attitude and skill levels of teachers on the use of ICT and how ICT influences student's achievement in mathematics. Finally, the findings of this study will form the most recent literature on the influence of ICT on student achievement in mathematics.

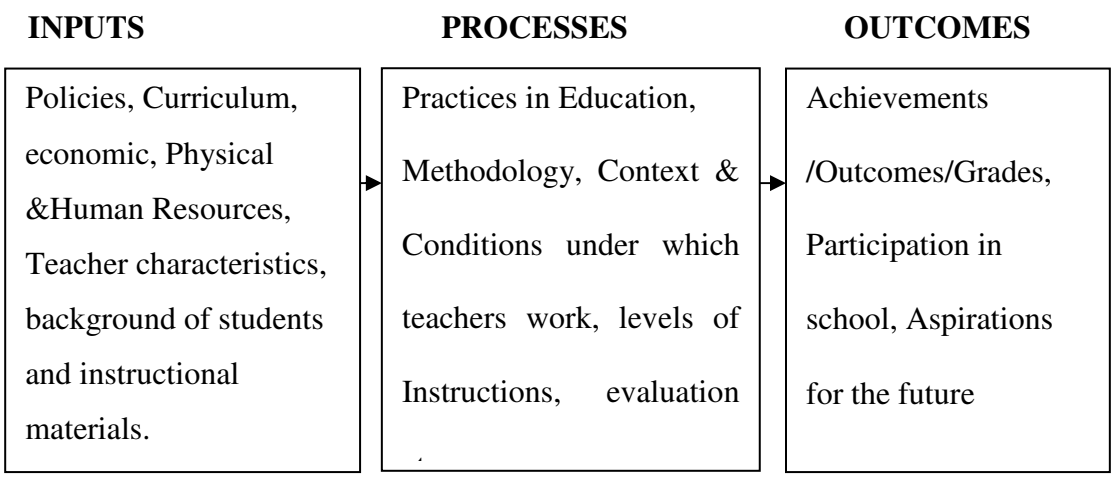
1.9 Theoretical Framework

This study was based on a conceptual model developed by Shavelson, McDonwell and Oakes (1987). The model presents the education system in terms of inputs (contents), processes and outputs. The inputs are the policy-related contents on national, county and local levels from which the intended curriculum is also designed and developed. They also include the economic, physical and human resources supplied to different levels of the system, the characteristics of the teachers and the background of the students. Inputs into system affect all the process of education, and ultimately, the outputs in form of student performance in a given subject area.

This theory is relevant to this study in the sense that, it has different processes. These processes are: methologies used in teaching, evaluation, motivation and actual teaching. They relate to what is taught and how it is taught in schools (inside the classrooms) in terms of the curriculum content (what is actually being taught in the classrooms), teaching situation (meaning the context and conditions under which teachers work) and instructions. The output, also seen as the outcomes, are finally seen in terms of the performance or achievements in mathematics, participation in class and school activities, learners attitudes towards learning of subject, and finally, their aspirations for the future. It is expected that, due to the dynamics of these processes there will be indirect benefits and

outcomes, such as improved learner participation partly due to improved curriculum quality and content delivery methods.

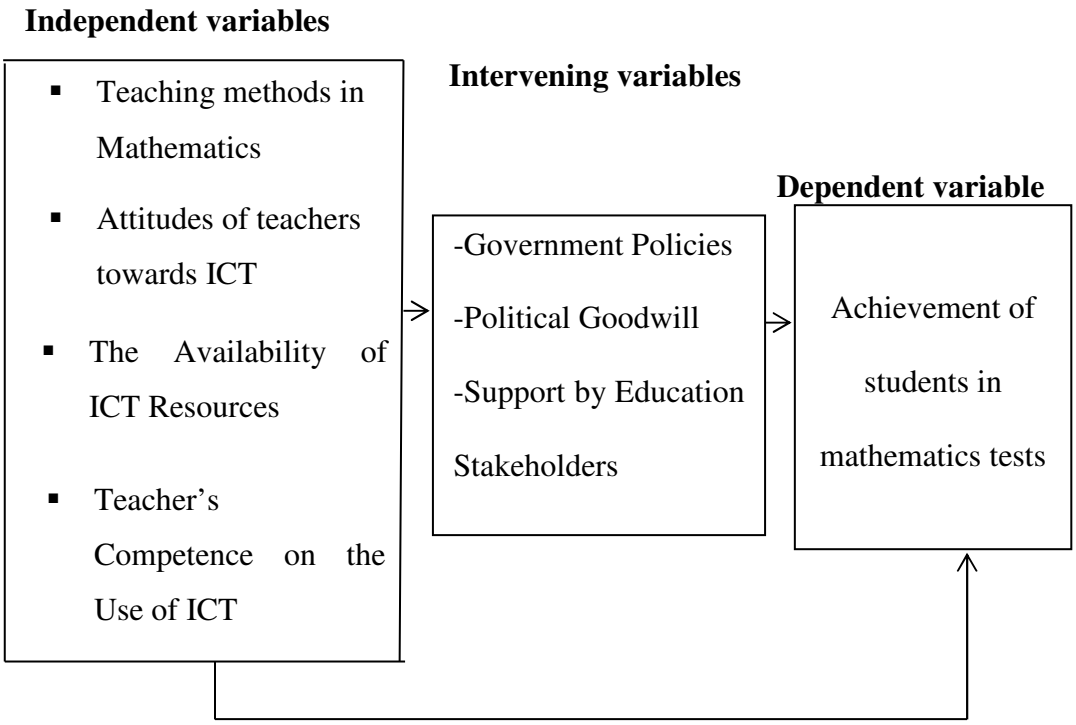
Fig. 1.0: An Overview of Education System



In this research, the inputs are the ICT resources, the processes are the integration practises carried out by the teachers, and the outcomes are the students' achievement in mathematics.

1.10 Conceptual Framework

The figure below shows the relationships between the study variables as conceptualized by the researcher.



Source: Researcher conceptualization of research variables

Fig 2.0: Conceptualization of Study Variables

The framework in figure 2.0 presents attitudes of teachers towards ICT, the availability of ICT resources, teachers' competence on the use of ICT and teaching methodology as the independent variables. Student achievement in mathematics tests is the dependent variable. The extent of influence of the independent variables on the dependent variables is moderated by intervening variables such as prevailing government policies, political goodwill and level of participation of all education stake holders, directly or indirectly linked to the education sector. They particularly influence the extent of provision and use of ICT in the teaching-learning process.

1.11 Definition of Operational Terms

ICT – stands for Information Communication Technology. Is a term which refers to unified communications and integration of telecommunications(Telephone and wireless signals) ,computers and their soft wares, storage and audio visual systems which enable students to access, store, transmit and manipulate information.

ICT Devices -These are tools and equipments like :- Projectors, computers, Radio, television, networked computers and internet, personal digital assistants like Tablets, smartphones, applications, programs, smart boards, Led-display boards.

Teaching methodology – are methods, strategies and principles used by mathematics teachers in the learning of mathematics.

Academic achievement- refers to the student's performance in the mathematics test administered.

Attitude - is the tendency of mathematics teachers to respond positively or negatively towards the use of ICT tools used in learning of mathematics.

Teaching learning process - is a deliberate intervention that involves the planning and the implementation of instructional activities and teaching experiences to meet intended learner outcomes.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter deals with review of related literature on the impacts of ICT integration on student achievement in mathematics. Through literature review, the researcher grouped the study into areas related to; the teaching methodologies, availability of ICT resources in schools, the teacher's level of skill and competence on ICT use, teacher attitudes towards ICT, and the general perceptions of students towards the use of ICT in the teaching-learning process.

2.1 Influence of Teaching Methodology on Student achievement in Mathematics

The primary purpose of teaching at any level of education is to bring a fundamental change in the learner (Tebabal & Kahssay, 2011). This process of knowledge transmission requires teachers to apply appropriate teaching methods that best suit specific objectives and level desired outcomes. Traditionally, many teaching practitioners widely applied teacher-centered methods to impart knowledge to learners as compared to student-centered methods. To date the questions about the effectiveness of teaching methods on student learning have consistently raised considerable interest in the thematic field of educational research (Hightower, 2011). Most of the teaching methods nowadays have embraced modern technology and this has brought changes in the field of learning.

Moreover, research on teaching and learning constantly endeavor to examine the extent to which different teaching methods enhance growth in student learning.

The poor academic performance by the majority students is fundamentally linked to application of ineffective teaching methods by teachers to impact knowledge to learners (Adunola, 2011). Substantial research on the effectiveness of teaching methods indicates that the quality of teaching is often reflected by the achievements of learners. According to Aypay, A. (2010) teaching is a process that involves bringing about desirable changes in learners so as to achieve specific outcomes. In order for the method used for teaching to be effective, Adunola (2011) maintains that teachers need to be conversant with numerous teaching strategies that take recognition of the magnitude of complexity of the concepts to be covered.

According to Ayeni (2011), teaching is a continuous process that involves bringing about desirable changes in learners through use of appropriate methods. It is through these methods that learners are able to understand the content being taught and acquire knowledge and skills. Adunola (2011) indicated that in order to bring desirable changes in students, teaching methods used by educators should be best for the subject matter. Furthermore, Bharadwaj and Pal (2011) sustained that teaching methods work effectively mainly if they suit learners' needs since every learner interprets and responds to questions in a unique way, as such alignment of

teaching methods with students' needs and preferred learning influence students' academic attainments.

In teacher- centered methods, students simply obtain information from the teacher without building their engagement level with the subject being taught. The approach is least practical, more theoretical and memorizing (Tebabal & Kahssay, 2011). It does not apply activity based learning to encourage students to learn real life problems based on applied knowledge. Since the teacher controls the transmission and sharing of knowledge, the lecturer may attempt to maximize the delivery of information while minimizing time and effort. As a result, both interest and understanding of students may get lost. To address such shortfalls, Zakaria, Chin and Daud (2010) specified that teaching should not merely focus on dispensing rules, definitions and procedures for students to memorize, but should also actively engage students as primary participants.

Student-Centered Method is more encouraged because it embraces the concept of discovery learning, many scholars today widely adopt student-centered methods to enhance active learning Brindley (2015*)*. Most teachers today apply the student-centered approach to promote interest, analytical research, critical thinking and enjoyment among students (Hesson & Shad, 2007). The teaching method is regarded more effective since it does not centralize the flow of knowledge from the lecturer to the student. The approach also motivates goal-orientated behavior

among students, hence the method is very effective in improving student achievement. The subject information produced by the learners is remembered better than the same information presented to the learners by the lecturer. The method encourages the students to search for relevant knowledge rather than the lecturer monopolizing the transmission of information to the learners. As such, research evidence on teaching approaches maintains that this teaching method is effective in improving students' academic performance.

ICT's have been proven to play an important role in the teaching-learning process as it provides learners with the understanding, skills and knowledge necessary for scientific research, thus improving their standards of living (Munishi, 2004). They also enable learners to acquire problem-solving and decision-making skills, which provide ways of thinking and inquiry. With the rapid usage of Information and Communication Technology resources (e.g. internet), ICT based teaching-learning applications are considered an effective alternative to traditional teaching methods because it presents students with unlimited opportunities to demonstrate the mastery of contents taught (Lei & Zhao, 2007).

Meta-analytic studies about the relationship between ICT and pupils' achievement in comparison with traditional instruction have shown that ICT have a positive impact on pupils' achievement level (Lei, 2007). There are other numerous studies claiming that ICT positively affect pupils' learning (Harris, 2011; Pili & Aksu,

2013). The essence of these studies suggest that because of ICTs' flexible nature, educators (and pupils themselves) can find ways to accommodate pupils' needs for better achievement. Despite these numerous advantages of ICT use, there is a little evidence that it actually makes any difference in pupils' achievement levels in mathematics.

Meta-analysis study revealed that on average, students who used ICT - based instruction scored higher than students without computers. The students also learn more in less time and like their classes more when ICT-based instruction was included (Song &Kang, 2012). A construct database of 67 sections of introductory economics in 15 institutions in the United States of America found significant but small positive correlations between the use of ICT and performance. Fuchs and Woessman (2011) showed that while the bivariate correlation between the availability of ICTs and students' performance is positively strong and significant, it becomes small and insignificant when students' characteristics such as students' negative attitude and perceptions towards ICT use are taken into consideration.

2.2 Influence of Teacher's Attitudes towards ICT on Student Achievement

Student academic achievement can be influenced by teachers' attitudes towards the use of ICTs in teaching and learning. Research shows that the success of technology use in the educational settings largely depends on teachers attitudes

toward technology use (Baylor & Ritchie, 2012). Teachers' attitudes are considered as a major predictor of the use of new technologies in the educational settings. Thus, their attitudes toward computer can play an important role in the acceptance and actual use of computers. The successful utilization of technologies in the classroom depends mainly on the teachers' attitudes toward these tools (Kluever, 2014). Correspondingly Harrison and Rainer (2012), a number of studies were carried out to determine teacher attitudes toward computer use, conducted their research using data compiled from a 1990 survey of 776 knowledge and information workers from a large university in the southern United States. They found that participants with negative computer attitudes were less skilled in computer use and were therefore less likely to accept and adapt to technology than those with positive attitudes. Albirini (2014) conducted a study to investigate the attitudes of EFL teachers in Syrian high schools toward technology in education, both quantitative and qualitative methods were employed to collect data. He found that the results from both quantitative and qualitative data indicated that teachers had positive attitudes toward technology use in education.

Scrimshaw (2004) stressed that, ICT can increase teachers' enthusiasm and efficiency, pro-mote their co-operation and planning with ICT, reduce their workload, help them alter their traditional pedagogical beliefs, implement new student-centered teaching strategies, and enhance stronger relationships between teachers and students, amongst others. However, these can only be achieved with

the teacher playing a central role as a change agent, by believing in the innovation and having positive attitude towards it. Actually, the attitude of the teacher will determine if this innovation is going to succeed or fail (Pelgrum & Anderson, 2013). Fishbein (2005) described attitude as "learned pre-disposition to respond in a consistently favorable and unfavorable manner with respect to a given object". During the last two decades, with the wide expansion of technology in schools, a considerable number of research studies have been conducted about the attitudes of educators (teachers) towards ICT integration. The results indicated that a respectable number of educators hold a negative attitude towards ICT integration, exhibiting negative reactions to computers ranging from "mild discomfort to extreme avoidance" ,(Todman, 2000) Computer anxiety is a "real phenomenon" which is evident "at close to one-third of the industrialized population of the world" (Korukonda & Finn, 2003).

Many attitude scales have been constructed to assess the attitudes of teachers, towards ICT (Korukonda & Finn, 2003). The scales consisted of various sub-scales, which can be summarized in four general categories as follows; Computer Anxiety, Self-efficacy/ Confidence, Enthusiasm/Liking/Enjoyment, Usefulness in Personal and Social Life. The most prevalent independent variables that have been used to assess the teachers' attitudes towards ICT can be categorized in two groups: demographics (age and gender) and computer experience (training, years of using computer, ownership of computer, access to a computer, intensity of

computer use). Regarding the gender effect, the studies found out that, both male and female teachers held positive attitudes towards ICT with males having stronger positive attitudes than their female counterparts, (Bhat-tacharjee, 2008; Vollmeyer & Beierlein, 2007).

The study also found that the age and years of service of the teacher are an indication of his/her attitudes towards ICT: the fewer years of service (therefore the younger he/she is), the more positive attitudes he/she has. The relationship between age and computer attitudes has been investigated in several studies but the results are contradictory. Becta, (2004) indicated that as teachers' age increases, the percentages of teachers using computers and the internet decreases. Pelgrum and Anderson, (2013) investigated the perceptions of teachers towards computers in several countries; found that age does not play an important role in determining the educators' attitudes towards computers. Interestingly, Dawson and Rakes (2003) found that the age of the teacher is critical factor affecting technology integration in schools, with older teachers (ages 41 to 55 years) influencing technology integration more than younger teachers. It is however instrumental to note that, teachers' involvement in ICT use is undoubtedly influenced by the working contexts in which teachers find themselves in. Innovation and adaptation are costly in terms of the time needed to develop and establish new practices. In addition to the new interpersonal and pedagogic skills which teachers require to use ICT in their classrooms, other contextual factors which can act as barriers to

positive attitudes include; lack of motivation, un-timetabled use of dedicated ICT suites, unreliability of equipment; classroom practices which clash with the culture of student exploration, and interactivity within which much technology-based activity is said to be situated (Gakuu & Kidombo, 2010).

The cultural norms and practices, which operate with integration of ICT into subject teaching, need to overcome the organizational and political obstacles arising, as well as teachers' personal and professional perspectives. The interview comments collected from different researches indicated that teachers experienced both pressure to use ICT, and a desire to exploit technology and change pedagogy accordingly. There is a perceived tension between using ICT and the need to conform to external regulations e.g. by the school administration, internal and external examination bodies, the government and the sponsors.

2.3 Influence of the Availability of ICT on Student Achievement in Mathematics

Hennessy, Ruthven and Brindley (2015) supported the idea that developing countries' low levels of learning among children can be partly attributed to poor and inadequate facilities in the schools. Instructional resources which are educational inputs are of vital importance to the teaching and learning of any subject in the school curriculum. Wainer, *et al.,* (2008) was of the opinion that the use of instructional resources would make discovered facts glued firmly to the

memory of students. He also added that a well-planned and imaginative use of audio-visual aids in lessons should do much to banish apathy, supplement inadequacy of books as well as arouse student's interest in learning, by giving them something practical to see and do and at the same time, train them to reason out concepts on their own. He pointed out that, the selection of materials which are related to the basic contents of a course or a lesson, helps in in-depth understanding of such a lesson by the students, in that, they make the lesson attractive to them, thereby arresting their attention and thus motivating them to learn.

In enumerating the factors that could be responsible for varying intra and inter-school/academic achievement, Coombs (2010) listed four important factors including the acute scarcity of instructional resources which he said constrained educational systems from responding more fully to new demands. He claimed that, in order to combat the crisis in education, educational systems will need a fuller share of the nation's manpower, not merely to carry on the present work of education, but to raise its quality, efficiency and productivity. They will need buildings, equipment and more learning materials. The most pronounced finding of empirical studies on ICT impact is that, there is a consistent relationship between the mere availability of ICT equipment and student achievement. Two major studies in the U.S. found a positive relationship between availability of computers in schools and the results of test scores. Two large studies, an

international study by Fuchs and Woefsmann (2011) involving 31 developed and developing countries, and another by Wenglinsky (2004) surveying U.S. schools, found a positive relationship between the availability of computers in the home and student scores.

Students in this study were tested on mathematics and reading but the data collected on computer use was general; even the educational use was not specific to any subject. In order to understand the connection between the input (computer use) and the output (performance in subjects), it is essential to have the learning measurement directly correspond to subject area in which the technology is used. Some studies have looked at this direct relationship. For example, the Wenglinsky (2004), study cited above, measured the amount of computers used in mathematics classes and scores on math tests. The study found a positive relationship between the use of computers and learning in both 4th and 8th grades. Conclusions from such studies are limited by the fact that they use correlation analysis. With this type of analysis, factors are simply associated with each other. It cannot be concluded with confidence that one causes the other. For example, it may be that the brightest students use computers most and it is student ability that accounts for higher scores rather than computer use.

Causality can only be assured with controlled experiments, where one group uses computers or uses them in a certain way and an equivalent group does not. An

example of this type of experimental study was conducted in Vadodara, India in which students in primary schools used computer mathematics games two hours a week and students in equivalent schools did not. The students who used computers scored significantly higher than the comparison students on a test of mathematics. The bottom group of the students benefited most and girls benefited as much as boys. One important limitation of this field- based experiment is the lack of a theory (and supporting analysis) of why some students gained more than others. Only by doing more in-depth data collection and analysis would the outcomes become apparent. While the Vadodara study is quite useful, conclusions can be drawn with the most confidence that, the accessibility and proper utilization of ICT equipment by students is directly proportional to the performance of the students in their specific subject areas. Egwali (2009) suggested that, the availability and Proper utilization of ICT equipment by capable ICT professional educators is paramount to their impact on the achievement of students in a subject.

The government of Kenya committed itself to introduce ICT in primary, secondary and tertiary institutions, as contained in ICT Draft Policy of 2006. According to the Draft Policy the government was to provide educational institutions with ICT resources in the form of computer hardware, software and ICT teachers. It is instructive to note that from as early as 1990, an increasing number of schools in Kenya acquired computers through the initiative of parents, community, politicians and non-governmental organizations, among others. Some of the

computers were donations from well-wishers (Kavagi, 2001). It has been noted that failure by educational institutions to embrace ICT innovation has been as a result of inadequate funding by the government. Without the financial support of the government and assistance from development partners, the introduction of computers in educational institutions will continue to remain an expensive venture in spite of the fact that the cost of hardware and software has been dropping over the years (MOEST, 2005).

This project takes cognizance of the fact that, most rural Kenyan schools have limited ICT resources and therefore fewer opportunities to benefit from developments made available through new technologies. It is imperative to note that the Kenya government supports education through provision of grants for the purchase of learning materials and hiring of teachers. ICT use in schools is recognized as exceptionally important by the Kenyan government and its population. In fact in June 2006, computers and their associated accessories were made tax free as a measure of this recognition. This positive aspect however still does not enable disadvantaged communities to equip their schools with the most basic ICT equipment due to the cost implications. A number of initiatives have delivered ICT infrastructure to schools, mainly at secondary level. These include initiatives supported by parents, the government, NGOs, or other development agencies and the private sector. Notable among, Computers for schools – Kenya, e-schools initiative, and the Microsoft Partners in Learning program (Microsoft,

2007). Other initiatives worth noting include Network Initiative for Computers in Schools (NICE) which coordinates member activities related to computer equipment sourcing, refurbishment, distribution, and maintenance.

A recent survey of 56 nationally spread (but purposefully selected) schools in Kenya having computers showed that 59% of the schools had received the computers through government and NGO donations, while 54% and 18% had been acquired from school funds and from the CFSK (Computers for Schools-Kenya) initiative respectively. The Parent-Teacher Associations and individual pupils had contributed to 16% and 7% respectively (Oloo, 2009). In conclusion, there is clear evidence of public-private partnership in ICT investments in education, especially in the delivery of computer hardware and software to schools, but no clear national statistics of the impact of these initiatives on student performance in mathematics.

2.4 Influence of Teacher's ICT Competence on Student Achievement

Sidhu (2002), asserts that, successful teaching and learning experience is a valuable asset because it helps the teacher acquire certain commendable characteristics such as; promptness, efficiency, adoptability and, ways of arousing and sustaining students' interest in the subject. Many studies examining ICT integration into instructional settings have revealed problems caused by the lack of teachers' knowledge, skills, and competencies related to such integration (Hennessy, *et.al* 2015). Several studies in this context have demonstrated the

existing problems of transferring ICT supported instructional materials into instructional settings. Akin focused on various barriers, including personal fears, technical/logistical issues, pedagogical concerns, and willingness to change. Similarly, Selwein (2011) clarified teachers' adaptation and implementation of information technologies is more difficult and time-consuming tasks than other instructional technologies The researchers concluded that teachers' perceptions and attitudes related to ICT skills and competencies are essential for comprehending the integration of ICT in school settings.

In order to use technology in the classroom effectively, teachers' perception toward technology should be positive and they should be trained using the modern technologies in the field of education. Studies have shown that only half of teachers who had access to computers used them in their lessons. Out of these, only two thirds of them felt confident to use ICT when teaching. This is because; innovative classroom use of computers depends not just on the availability of computers in schools but also on teacher training, and supportive plans and policies. The increasing investment in technology infrastructure has not been matched by investment of time and resources to develop new ways of learning and teaching; one of which is the training of teachers on effective use of ICTs. Despite numerous reported examples of effective use and apparent teacher motivation to develop their pedagogy and practice, clarification of what students should learn using ICT – and how teachers could facilitate this – is reported to be needed. Any

meaningful results in mathematics, is likely to be limited without guidance of this kind.

From several research findings, it appears that in-service training is a crucial factor that can improve, on the one hand, the teachers' attitudes towards ICT and on the other hand, facilitate their efforts to integrate ICT in their school (Dawson & Rakes, 2003). The importance of such training sessions has been emphasized by many scholars. Korukonda (2007), who studied factors contributing to computer anxiety, concluded that computer anxiety could be reduced through continuous education and training rather than just computer-based courses early on. According to Dawson and Rakes (2003), in-service training sessions should be continuous and extended, should correspond to the needs of all the teachers, and should be differentiated according to the level of knowledge of the teachers. A survey conducted among 23 primary school teachers in Cyprus, through telephone interviews revealed that, after ICT training, the majority of the teachers either changed their attitudes towards technology and/or acquired basic skills (Kang, Heo & Kim, 2011). However, the same research indicated that there was no significant impact of ICT training on using ICT in the learning process. It seems training practices have only had a significant impact on teachers' attitudinal stance where training participants had overcome their fears through using technology and became empowered by its opportunities on a personal level.

Many research studies conclude that there is a positive correlation between computer experience and positive attitudes, competence and comfort with computers (Schumacher & Morahan-Martin, 2001). The more computer experienced a person is, the more confident he/she is with computers. Many governments are using the introduction of ICTs as a way of providing teachers with new skills, and introducing new pedagogy into the classroom. For example, teachers who participated in the Enlaces program in Chile received two years of face-to-face training consisting of at least 100 hours. As a result, teachers acquired familiarity with computers and used them regularly for tasks that were professional (e.g. engaging in professional circles, e-learning), managerial (e.g. student marks, parental reports) and out of classroom (e.g. searching for educational content on the web, lesson planning).

The World Links program provided 200 hours of teacher training which included an introduction to ICT, use of the Internet for teaching and learning, use of Tele-Collaborative Learning Projects, integration of ICT into the curriculum and teaching, and innovative pedagogical approaches. The evaluation of the World-Links program found that a large majority of teachers and their administrators reported that, teachers learned these new computers and teaching skills, and gained more positive attitudes about technology and about teaching. The use of ICT has often been thought to bring significant changes into classroom practice. This was evident from school surveys conducted in 26 countries and a series of case studies

conducted in 27 countries in Europe, Asia, North America, South America, and Africa.

The extensive teacher training provided by the World Links program, resulted in teachers not only learning new skills but also changing their classroom practices. These practices included conducting research projects, gathering and analyzing information, collaborating on projects with pupils in other countries, and communicating with parents and other community members. However, there are also significant barriers to widespread ICT-supported change in classrooms in developing countries e.g. Kenya. These include lack of time in the curriculum and school, shortage of skilled personnel, and lack of infrastructure; including power, telecommunication access, and Internet service providers. National policies can address many of these barriers and make a difference in widespread use of ICT in the teaching and learning process. When countries commit to coordinating the introduction of computers with changes in the curriculum, pedagogy, and teacher training, changes in classroom practices are more likely to be widespread. Within this context the pedagogic beliefs in the potential of technology for transforming subject teaching and learning, is examined. This involves identifying the key 'affordances' (or perceived beneficial attributes) of using technology in the classroom, and describing teachers' caution and concerns about what accommodating its use may displace or threaten.

The report indicates that relatively few teachers are integrating ICT into subject teaching in a way that motivates students and enriches learning or stimulates higher-level thinking and reasoning. As other studies have found, these few tend to be teachers with an innovative pedagogic outlook. Otherwise, science and mathematics were simply using the technology to do what they have always done, although in fact they often claim to have changed their practice. One possible reason is that the teachers have historically had little say in designing and implementing development plans for using ICTs within their schools, and for defining its role within subject area. This is specifically true for countries with a centralized curriculum e.g. Kenya. Imposed policy decisions and mechanical change models often appear unresponsive to teachers' perspectives and their workplace constraints. According to Kerr's (2001) interviews and observations with American teachers who had successfully incorporated technology into their practice indicated that, using it allowed 'obvious and dramatic' changes in classroom organization and management. However, technology was not the driving force in teachers' thinking and practice. As well as serving as a 'lever' through which teachers seek to make established practice more effective, technology appears also to act as a 'fulcrum' for some degree of re-orientation of practice

2.5 Summary of Literature and Knowledge Gap

The reviewed literatures have shown that ICTs have extensively been applied in the field of education in many countries. Studies have also been done to assess their effectiveness in the teaching learning process, and on their level of contribution to student achievement. Study by Albirini (2014) on the attitudes of EFL (English as a foreign language) teachers in Syrian high schools toward technology in education found that teachers had positive attitudes toward technology use in education. A survey conducted among 23 primary school teachers in Cyprus, through telephone interviews revealed that, after ICT training, the majority of the teachers either changed their attitudes towards technology and/or acquired basic skills. However, the same research indicated that there was no significant impact of ICT training on using ICT in the learning process. Fuchs and Woelfsmann (2011) in their study involving 31 developed and developing countries, and another by Wenglinsky (2004) surveying U.S. schools, found a positive relationship between the availability of computers and student scores. Many research studies conclude that there is a positive correlation between ICT competence and student achievement. Lei (2007) did some meta-analytic studies about the relationship between ICT and pupils' achievement in comparison with traditional instruction and found that ICT have a positive impact on pupils' achievement levels.

Because the most important initial intention of integrating the ICT into teaching and learning is to improve students' academic performance, many studies have been devoted to finding evidence regarding the relationship between ICT use for education purposes and student achievements. Unfortunately, the findings have been quite complex in that some researchers have supported the positive influences of ICT use on achievement (Luu &Freeman, 2011; Bielefeldt, 2006; Ravitz & Mergendoller, 2002) while others have found the opposite.

Witter and Senkbeil (2008) found an entirely non-significant relationship between ICT use for education purposes and math, but Anil and Ozer (2012) found a positive correlation between them. Such mixed findings could be highlighting challenges related to effectively integrating ICTs into course content. Despite these theoretically sound advantages of ICT, there is a little evidence that it actually makes any difference in students' achievement levels in mathematics (Maddux & Cummings, 2004) This study therefore aims to fill this gap by investigating the influence of ICTs on student achievement in mathematics in public secondary schools in Dadaab Sub-County.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

This chapter outlines the research methodology for the study. It includes the description of the study location, research design, target population, sample size and sampling procedures, Research instruments, validity and reliability of instruments, data collection procedures, data analysis procedures, and ethical considerations

3.1 Research Design

According to Borg and Gall (1999), research design is a process of creating an empirical test to support or refute knowledge. It is also a plan and structure of investigation used to obtain answers to research questions. The study adopted a quasi-experimental design because of its ability to provide a better understanding of the research problem and detailed data which when well analyzed clearly depicted the extent of the problem. For a period of a month teaching (treatment) using ICT tools (this included smartboards, simulation games, spreadsheet programs, projectors, internet) was given to the experimental group whereas conventional methods were applied to the control group for the same duration. The data was collected by administering post-tests to randomly sampled research units. This research design suited the study because the researcher was able to manipulate variables to effectively assess the influence of the independent

variables on the dependent variable for both experimental and control groups. Furthermore, the design favours the use of questionnaires that simultaneously captured a broad spectrum of information from the respondents.

3.2 Study Location

The study was conducted in public secondary schools in Dadaab Sub County of Garissa County. Over the years, the average performance of mathematics in the Sub County has been far below the national average. Furthermore, the performance has been depicting a declining trend hence the reason why this location was isolated for the study. Two learning centres in the sub county comprising students randomly selected were established and it is in these centres where the groups were taught separately.

3.3 Target Population

Target population refers to all members of a real set of people, events or objects to which we generalize hypothetical results of the research (Borg & Gall 1999). The study targeted all the mathematics teachers, form two students and principals in all the 10 secondary schools in the sub-county. Form two students were targeted because at this level, the content starts to become difficult and abstract to the students. Any intervention that can make the content appear simplified will positively influence learners' attitudes towards the mathematics, and improve their academic achievement. Furthermore, inclusion of all the students in the study

proved cumbersome and difficult to undertake within the given period of time and limited resources. Mathematics teachers are directly involved in the teaching and assessment of the learners and this justified the reason for their inclusion in the study

3.4 Sampling procedure and Sample size

MacMillan and Schumacher (2001) suggests that in determining sample size, the researcher needs to obtain a sufficient number to provide credible results. MacMillan and Schumacher (2001) suggested that a sample of 20-50% of the total population is a sufficient number to provide credible results. Based on this, the researcher picked 50% of the 10 schools in the sub-county. Five public secondary schools, five school principals, all mathematics teachers and 30% of the total students were therefore selected. For fair representation, one girl's school, one boy's school and three mixed schools were considered. Sampling of the schools started with stratification of boys, girls and mixed gender schools. Simple random sampling was then used to pick the sample of each stratum. In this method, the names of schools in each category were written on small pieces of paper. The papers were then folded, placed in a bowl and mixed thoroughly to ensure randomization. The papers were picked one at a time to reveal the names of the participating school. Picking stopped when the desired sample size from each stratum was attained.

Based on the assertion of MacMillan and Schumacher (2001), 30% of students took part in the study. This yielded about 120 students from a population of approximately 408 form two students in the five sampled schools. The specific sample of students from each school was obtained by proportionate stratification using the following expression:

$$X = \frac{Ni}{No} \times n$$

where: x = students from each school

Ni = Total population of students

No = Total student population

n = total desired sample size (120)

This method ensured fair representation of the various strata into the study because the populations of form two students in the different schools were not homogenous. To arrive at the specific students who constituted the sample from each school, stratified random sampling and simple random sampling were used. The sampled students were distributed randomly and equally to the two learning centres where each centre received 60 students. All the mathematics teachers and one school principal in each of the sampled schools were purposively sampled to give a total of 155 respondents. Table 3.1 presents the sampling matrix for the study.

Table 3.1: Sampling Matrix

Category	Study Population	Total Sample Size	Sampling Procedure
Mathematics Teachers	30	30	Purposive sampling
Principals	10	5	Purposive sampling
Students	408	120	Stratified and simple random sampling
TOTAL	**448**	**155**	**-**

3.5 Research Instruments

Achievement tests, structured questionnaires, and interview guides were used to collect the pertinent quantitative and qualitative data from the respondents.

3.5.1 Questionnaires

Questionnaires were used for the mathematics teachers and an interview guide for the school principals. The questionnaire was divided into different sections according to the research objectives. The questionnaire consisted of five sections; A, B, C, D and E. Section A captured the demographic information of the respondents. Section B contained items on the availability of ICT; Section C had items on competence of teachers on ICT and section D assessed the attitudes of teachers towards the use of ICT in the teaching and learning of mathematics and Section E contained items on the influence of ICT on student achievement in

mathematics. The questionnaires captured both qualitative and quantitative data through open and closed ended items respectively. Quantitative data was based on structured items in 5-point Likert scales of measuring attitudes.

3.5.2 Interview Guide

Interview guide was used for the principals. Interview guides have a high reliability and give in-depth information (Kombo &Tromp, 2007). The interview schedule collected information on the availability ICT resources in schools, teacher competence in ICT use, attitudes of teachers towards the use of ICT in teaching, and the influence of ICT on student achievement. Through the interviews, the study also obtained suggestions on how ICT can best be integrated in the teaching and learning of mathematics so as to improve student achievement in mathematics

3.5.3 Achievement Tests

Achievement tests were used to measure students' achievement in mathematics through pre-test and post-test. The items of the test were confined to Surface Area of solids, Similarity and enlargement and Rotation, which are some of the topics identified by Kenya National Examination Council (KNEC) as poorly performed by students in National examinations. The test had ten questions cutting across the afore-mentioned topics and the maximum score a student could earn was 50

marks. The questions were arranged in levels of difficulty taking into consideration the different levels of Bloom taxonomy

3.6 Validity of Instruments

According to Borg and Gall (1999), validity shows whether the items measure what they are designed to measure. Face and Content validity for the tests and the queationnaire was done to determine the clarity, accuracy, and suitability of the research instruments. For this study, validity of the tests was assessed by expert judgement of the two supervisors guiding in the study from Machakos University. Pre-testing was also conducted to determine the validity of the questionaires and interview schedule. This was done in two schools in the neighboring Wajir south sub-county in Wajir county with similar characteristics as the sample schools. Based on the analysis of the pre-test, the researcher examined the responses to establish the level of ambiguity of the questions and made necessary adjustments to the instruments.

3.7 Reliability Of Instruments

Reliability refers to the consistency of the research instruments and the extent to which the study can be replicated (Mugenda & Mugenda, 2003). For this study, reliability was assessed through test-retest technique. To estimate test-retest reliability the instrument, the same test was administered to the same sample on two different occasions. In this method, the research instrument was administered to the pilot sample twice; with a lapse time of two weeks. The correlation between

the scores of the two was then used to estimate the reliability of the instruments. Pearson product-moment correlation coefficient was computed using the following expression as recommended by Ogulla (2005).

Pearson's Coefficient of Correlation,

$$r_{xy} = \frac{N\sum xy - \left(\sum X\right)\left(\sum Y\right)}{\sqrt{\left[N\sum X^2 - \left(\sum X^2\right)\right]\left[N\sum Y^2 - \left(\sum Y^2\right)\right]}}$$

Where

N- Number of respondents

X- Scores from the first test

Y- Scores from the second test

The questionnaire and the interview schedule yielded reliability coefficients of 0.79 and 0.83 respectively. Mugenda and Mugenda (2003) asserted that a coefficient ≥0.7 was adequate for an instrument to be considered reliable. based on this assertion, the instruments were considered highly reliable for the study. The instruments were subsequently adopted and used in the study.

3.8 Data Collection Procedures

The researcher sought authorization from Machakos University in order to obtain research permit from NACOSTI then reported to County Director of Education and County Commissioner of Garissa to conduct the research. After the researcher was offered with the clearance certificate, then placed a formal request in writing for permission to all the respondents to carry out the research. The researcher

visited the schools, met the authorities and requested for permission to conduct the research. The researcher identified, set the learning centres and administered research instruments by moving from one school to the other when collecting data.

The researcher randomly assigned the learners into the two groups (experimental and control groups) and was directly involved in the teaching of the students in the two groups: the experimental group (n=60) and the control group (n=60). Teaching of the two groups was done separately but the content was the same for both groups. The researcher met the groups for one session in a week (over the weekend at the learning centers since all the learners where day scholars) and each session lasted for 120 minutes (two hours). One hour was for teaching and the other for practicing the skills learned. This meant that, within the one month period, the researcher had eight contact hours with the participants of each group. The Experimental group was taught using ICT tools while those in the control group were taught using conventional methods for a period of one month. A pre-test was administered to the learners in both groups before the actual teaching commenced. The test was marked and the scores recorded. After the lapse of this period, a post-test was administered to both groups, marked and the marks again recorded. The researcher administered the questionnaires to the teachers and did a face-to-face interview with the principals in person. This was done by first obtaining their informed consent and booking an appointment with them.

3.9 Data Analysis Procedures

After data collection, the researcher did conduct data cleaning, which involved the identification of incomplete or inaccurate responses. The responses were then corrected in order to improve their quality. After data cleaning, the data was coded and entered in the computer for analysis using the Statistical Package for Social Sciences (SPSS) program. Qualitative data was analysed through categorisation of the data into themes then it was coded and entered into a computer program for analysis(quantitization of data). The data was analysed descriptively and inferentially. Descriptive statistics involved means, modes and standard deviations while inferential statistics involved the determination of Pearson chi-square test for independence to determine the relationship between variables, and T-tests for independent groups to assess whether a significant differences exists in the mean achievement of the two study groups. From the results of the analyses, the researcher was able to infer accordingly and make correct decisions on hypotheses. The analyzed data was presented in the form of tables, charts and graphs.

3.10 Ethical Considerations

A range of measures were taken to ensure the rights and safeties of the participants are safeguarded. These included confidentiality of respondent identities, anonymity and faithfulness. Data collection was solely based on the voluntary participation of respondents. No coercion was done at any point in time to solicit responses from participants.

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND DISCUSSION

4.1 Introduction

This chapter focuses on the questionnaire return rate, demographic information of the respondents, presentation, and discussion of findings on the influence of ICT on student's academic achievement in the teaching and learning of mathematics in secondary schools. The presentations and discussions have been done based on the research questions, reviewed literature and emerging trends in findings.

4.2 Questionnaire return rate

Questionnaire return rate is the proportion of the sample that participated as intended in all the research procedures. All the questionnaires administered to mathematics teachers were returned; representing a questionnaire return rate of 100 percent which is consistent with Mugenda and Mugenda (2003) who suggested that for proper generalization of research findings a response rate of 50% is adequate for analysis, while a response rate of 70% and above is excellent for statistical reporting. The high questionnaire return rate was possible because the researcher administered the questionnaires in person through a drop-wait-and-collect method; whereby, the questionnaires were administered to the respondents, allowed some time to fill them, and picked immediately after they were dully filled.

4.3 Demographic information of the respondents

This section dealt with the demographic information of the respondents; who were mainly students, mathematics teachers and principals in the sampled public secondary schools in Dadaab Sub-County.

4.3.1 Gender of respondents

The study sought to know the gender of the respondents taking part in the study in a bid to ensure that the study was not gender biased and that; the views of both genders were incorporated into the study. Table 4.1 below summarizes the gender of the respondents

Table 4.1 Distribution of respondents by gender

Gender	**Students**		**Maths Teachers**		**Principals**	
	Freq.	%	Freq.	%	Freq.	%
Male	63	52.5	12	73.3	4	80.0
Female	57	47.5	8	26.7	1	20.0
Total	**120**	**100.0**	**20**	**100.0**	**5**	**100**

Table 4.1 above shows that, 52.5% of students, 73.3% of mathematics teachers, and 80 percent of principals were males respectively. On the other hand, 47.5% of students, 26.7% of teachers and 20% of the principals were females in that order. This implied that, of all the respondents, males were the majority. It also signifies that the study was gender representative.

4.3.2 Age of Respondents

The study sought to establish the age variation of the teachers in the sampled schools. Figure 4.1 presents the findings obtained

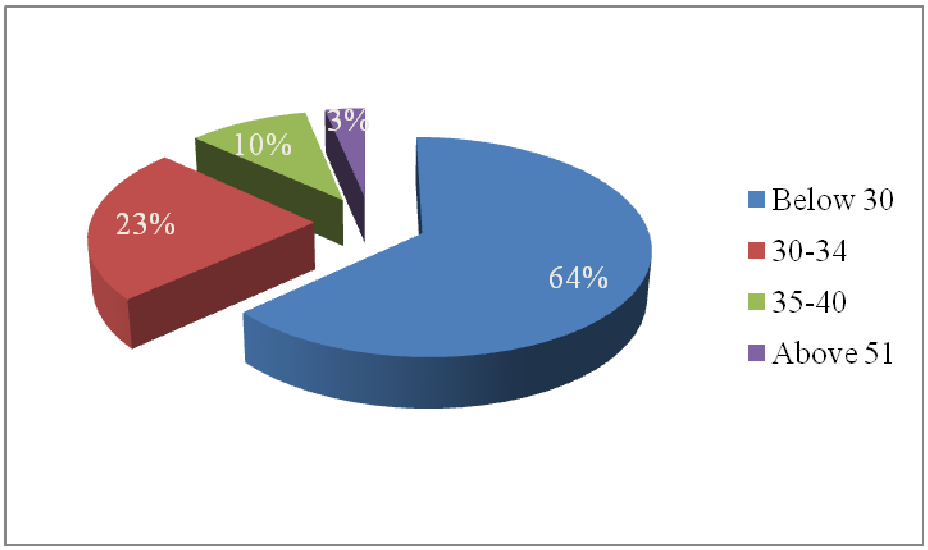


Figure 4.1: Age Distribution of Mathematics Teachers

From Figure 4.1, 64% of teachers were below 30 years; 23% were between the ages of 30-34, 10% were aged between 35 and 40 years while 3% were above 50years. This indicated that more than three quarters of teachers in Dadaab sub-county were youthful, energetic and within the digital age. It is therefore expected that majority of them should be able to comfortably apply ICT resources in teaching.

4.3.3 Highest academic qualifications of respondents

The academic qualifications of the mathematic teachers were sought by the study in order to establish whether they had attained the minimum prerequisite qualification to teach in secondary schools. The findings are summarized by figure 4.2

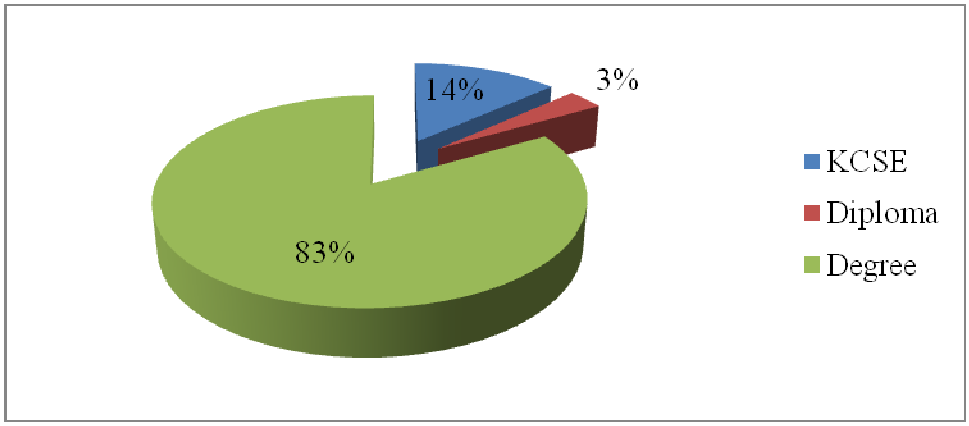


Figure 4.2: Highest academic qualifications of mathematics teachers

Figure 4.2 indicate that 83.3% of mathematics teachers were degree holders while 14% and 3% had diploma and KCSE certificates respectively. It is imperative to note that the minimum qualification required of a teacher to teach in a secondary school is a diploma in education. Therefore, the presence of teachers with lower qualifications might compromise the quality of teaching and can also be indicative of the level of shortage of teachers with suitable qualifications in the area

4.4 Influence of teaching method on students' achievement in mathematics

Objective one sought to determine the actual influence of teaching methodology on students' achievement in mathematics. It focused on the methodologies adopted by teachers in the teaching and learning of mathematics. The teachers were therefore asked to indicate the frequency with which they used the particular methodologies. This was based on a scale of; Very Often-rated 1; Often – rated 2, Sometimes – rated 3; Rarely – rated 4, and Never, rated 5. Table 4.2 presents the findings

Table 4.2: Descriptive statistics on teaching methodologies used by teachers

Methodology	N	Min	Max	Mean	Std. Dev
Pure traditional methods	30	1.00	3.00	1.9000	.80301
ICT integrated methods	27	1.00	5.00	3.0741	.95780

From table 4.2, it is evident that majority of the teachers often applied traditional methods as opposed to the use of ICT resources. This is according to the means of 1.90 and 3.07 respectively. This implied that teachers were yet to fully embrace the integration of ICT's in the teaching of mathematics in public secondary schools in Dadaab sub-county. When the teachers were asked to draw a comparison between traditional and ICT methods in as far as the contribution to better student achievement was concerned, 21 (70%) of them responded in favour of ICT while nine (30%) cited traditional methods. Similarly, 87.5% of the principals favoured the use of ICT and the rest (12.5%) teamed up for traditional methods. This is consistent with Munishi, (2004) who maintained that ICT's play an important role in the teaching-learning process as it provides learners with the understanding, skills and knowledge necessary for scientific research, thus improving their standards of living

The teachers were also required to rate the achievement of their students in mathematics. The results are as presented in Table 4.3

Table 4.3: Teachers' ratings of student performance in mathematics

Rating	**Teachers**		**Principals**	
	Frequency	Percent	Frequency	Percent
Excellent	1	3.3	-	-
Good	10	33.3	1	12.5
Average	16	53.3	5	62.5
Below Average	3	10.0	2	25.0
Total	**30**	**100.0**		**100.0**

From table 4.3, 33.3% and 53.3% had rated student achievement in mathematics as good and average respectively. Only 3.3% rated student achievement as excellent while 10% indicated a below average achievement. For the principals, 12.5% rated the achievement as good, 62.5% as average and 25% as below average. This meant that students' achievement in the sampled schools was far from impressing.

From the raw scores of the pre-test and the post-test, descriptive analysis was done to obtain minimum and maximum scores in each test, the means of each test and the standard deviations. Tables 4.4 summary of the analyses of control and experimental groups respectively

Table 4.4: Descriptive analysis of test scores of control group

Group	N	Min	Max	Mean	Std. Deviation
Control (pre-test)	60	14.00	60.00	35.0500	12.66173
Control (post-test)	60	15.00	64.00	37.8000	12.70500

Descriptive analysis of test scores of experimental group

Group	N	Min	Max	Mean	Std. Dev
Experimental (pre-test)	60	11.00	62.00	35.5000	12.78969
Experimental (post-test)	60	22.00	78.00	40.8833	12.59821

From Table 4.4 the means of the pre-test for both the control and the experimental group are almost the same. However, the post-test analysis shows variation in means but to different magnitudes. The control group registered a small positive deviation in mean score of +2.75 while the experimental group registered an appreciable deviation of +5.3833. With regards to the individual scores, the control group realized a marginal improvement from a maximum of 60 in the pretest to 64 on the post test. On the other hand, the experimental group recorded a maximum score of 62 in the pretest but managed a maximum of 78 in the post test. The slight improvement in achievement for the control group could be attributed to the fact that the learners were being taught and assessed on the topics for a second time. However, for the experimental group, the noticeable improvement could be as a result of the intervention that was made in the teaching approach by integrating the use of ICT in teaching.

Based on these findings, the researcher was interested in establishing whether student achievement in mathematics was related to the teaching methodology used. To do so, bivariate correlation analysis was done and the results presented in table 4.5

Table 4.5: Correlations between student achievement and teaching methods in mathematics

Method		Traditional methods	ICT integrated methods	student achievement in math
Pure traditional methods	Pearson Correlation	1		
	Sig. (2-tailed)			
ICT integrated methods	Pearson Correlation	.715**	1	
	Sig. (2-tailed)	.000		
student achievement in math	Pearson Correlation	.505	.585	1
	Sig. (2-tailed)	.126	.104	

Correlation is significant at the 0.01 level (2-tailed); n=30

Table 4.5 indicates strong positive correlations between teaching methods and student achievement in mathematics. The use of ICT is correlated to student achievement at r=0.585 but the finding is not significant as p>0.05. On the other hand, traditional methods of teaching are correlated to student achievement and the finding is not significant (r=0.505, p>0.05). The findings show that ICT is a better

correlate of student achievement compared to traditional methods. It is however of importance to note the strong and significant relationship between ICT and traditional methods ($r=.715$, $p<0.001$) which means the two methods are inseparable in the teaching learning process and for a teacher to optimize student achievement in mathematics; he/she should use both methods concurrently. The findings share similarity with that of a study by Song and Kang, (2012) who found significant but positive impact on students' performance due to ICT use. Similarly, Meta-analytic studies by Lei, (2007) about the relationship between ICT and pupils' achievement in comparison with traditional instruction showed that ICT have a more positive impact on pupils' achievement than traditional methods. This difference in achievement could be attributed to the fact that ICT based teaching-learning applications are considered an effective alternative to traditional teaching methods because it presents students with unlimited opportunities to demonstrate the mastery of contents taught

The study went ahead to establish whether differences existed in the mean performance of students taught using ICT (experimental group) and those taught using traditional methods (control group). This was done by conducting t-tests of independent samples and the results are summarized by Table 4.6

Table 4.6: T-test for Independent Samples

	t-test for Equality of Means				
	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Equal variances assumed	8.292	58	.000	21.35556	2.57550
Equal variances not assumed	8.207	23.63	.000	21.35556	2.60198

The analysis in table 4.6 depict a significant difference in the mean achievement between students taught using ICT and those taught using traditional methods (for equal assumed variance, $t=8.292$, $p<0.001$). This means that the use of ICT in the teaching of mathematics significantly and positively influence students achievement in mathematics. Based on this finding, the null hypothesis that the teaching methodology does not significantly influence student achievement was rejected. This implies that, in order to bring desirable changes in students, teaching methods used by educators should be best for the subject matter and should suit learners' needs since every learner interprets and responds to questions in a unique way As such, alignment of teaching methods with students' needs and preferred learning influence students' academic attainments

4.5 Influence of teachers attitude towards ICT on student achievement in mathematics

Objective two sought to establish how teacher's attitude towards ICT's affects students' achievement in mathematics. This was systematically done by first seeking the perceptions of teachers towards ICT use in teaching. Figure 4.4: presents the findings

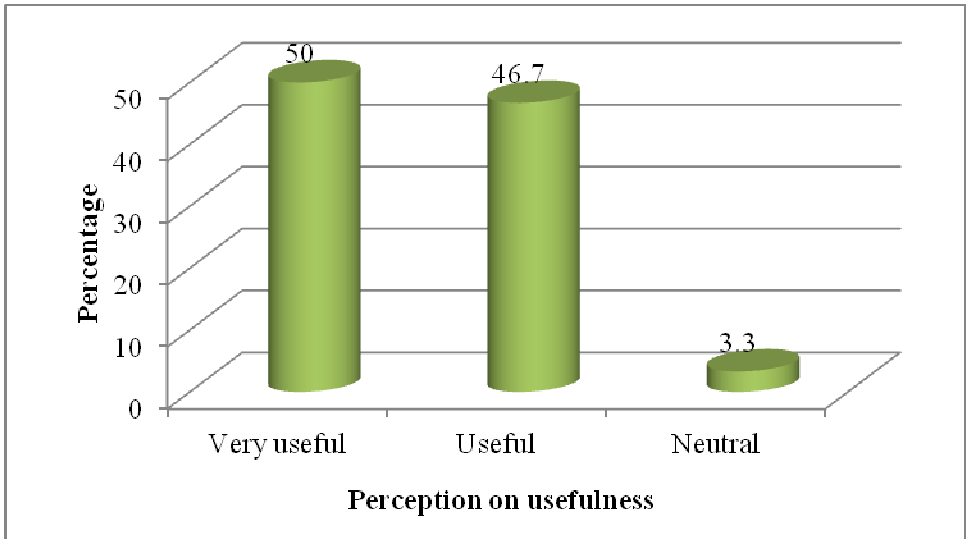


Figure 4.3: Perceptions of teachers towards the use of ICT in teaching

From figure 4.3, half of the teachers (50%) find the use of ICTs in teaching very useful and almost similar percentage (46.7%) think they are useful. However, a small number (3.3%) could not make their minds and hence remained neutral in their responses. When the principals were asked to give their opinion on the general attitude of principals towards ICT, 87.5% of them said that it was positive while 12.5% said it was negative. This implies that, teachers generally have positive attitudes towards ICTs and this is very important because for teachers to

effectively integrate ICT resources in the teaching-learning process, they have to first of all embrace them. The findings replicate those of a study by Albirini (2014) which found that teachers had positive attitudes toward technology use in education. The findings however contradict Todman, (2000) who indicated that a respectable number of educators held a negative attitude towards ICT integration.

A cross tabulation was further conducted to establish whether variations in attitude towards ICT existed among teachers of different age and gender. Tables 4.7 and 4.8 present the results

Table 4.7: Cross tabulation between teachers' age and perceptions towards ICT use

Response	**Age bracket**				**Total**
	Below 30	30-34	35-40	Above 51	
Very useful	10	3	2	0	15
Useful	8	4	1	1	14
Neutral	1	0	0	0	1
Total	**19**	**7**	**3**	**1**	**30**

From table 4.7, majority of teachers who find ICT very useful or useful are those of ages below 30 years and 30-34 years respectively. This means that the youthful teachers are more enthusiastic toward ICT but as the age advances, that enthusiasm reduces. The findings are in concurrence with findings by the

European Commission (Becta, 2004) which found that the younger teachers were more positive to ICT than their aged counterparts. The study further indicated that as teachers' age increases, the percentages of teachers using computers and the internet decreases.

The researcher also conducted a cross tabulation between gender and perceptions towards ICT. Table 4.8 summarizes the findings.

Table 4.8: Cross tabulation between gender and perceptions towards the ICT

	Gender		**Total**
	Male	Female	
Very useful	10	5	15
Useful	11	3	14
Neutral	1	0	1
Total	**22**	**8**	**30**

From the findings, both male and female teachers find ICT resources useful in teaching. This implies that the perception/attitude of teachers towards ICT is not biased by gender. The findings mirror Bhat-tacharjee, (2008); Vollmeyer and Beierlein, (2007) who found out that, both male and female teachers held positive attitudes towards ICT with males having stronger positive attitudes than their female counterparts.

Having assessed teachers' perceptions towards ICT, the study went ahead to establish the attitudes of teachers towards ICT resources, and their use in teaching. The teachers were therefore asked to give their responses on a scale of: Strongly Agree-rated 1, Agree-rated 2, Undecided-rated 3, Decided-rated 4 and Strongly Disagree-rated 5. Table 4.9 summarizes the responses obtained.

Table 4.9: Attitudes of teachers towards the use of ICTs in teaching

Response	Min	Max	Mean	Std. Dev
ICT resources help me organize my work	1.00	3.00	1.7000	.59596
Using ICT tool would make the subject matter more interesting	1.00	2.00	1.5517	.50612
Using ICT tools in teaching saves time and effort	1.00	4.00	1.7586	.78627
ICT makes me much more productive in my teaching	1.00	4.00	1.8966	.67320
ICTs can positively enhance student learning	1.00	2.00	1.4000	.49827
I would rather use conventional methods that use ICT in teaching	1.00	5.00	3.4333	1.13512
I enjoy using ICT tools in teaching	1.00	4.00	1.7000	.70221
I hate using ICT tools in teaching because i fear embarrassment	1.00	5.00	4.2000	1.12648

n=30

From table 4.9 majority of the respondents either agreed strongly with the statements that ICT resources help them organize their work (1.7000), using ICT tool would make the subject matter more interesting (1.5517), using ICT tools in teaching saves time and effort (1.7586), ICT makes me much more productive in my teaching (1.8966), ICTs can positively enhance student learning (1.4000) and enjoy using ICT tools in teaching (1.7000). They however were in disagreement with the statement that they fear using ICT for fear of embarrassment (3.4333). On whether to use ICTs or traditional methods, most of the respondents were undecided implying that they were non-committal to a particular method but would prefer a blend of both. This is in order owing to earlier findings that, for optimal results, teachers ought to use both methods concurrently in the teaching learning process. Research shows that the success of technology use in the educational settings largely depends on teachers attitudes toward technology use (Baylor & Ritchie, 2012). Teachers' attitudes are considered as a major predictor of the use of new technologies in the educational settings. Thus, their attitudes toward computer can play an important role in the acceptance and actual use of computers

To test the hypothesis that no relationship exists between teacher attitudes towards ICT and student achievement in mathematics, chi square test for independence was conducted to measure independence of the variables as in table 4.10

Table 4.10: Chi-Square Tests for Independence

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	89.404[a]	80	.221
Likelihood Ratio	41.576	80	1.000
Linear-by-Linear Association	.292	1	.589

n=30

Using the linear-by-linear association statistic a asymptotic significant of $p>0.05$ between teacher attitude and student achievement hence the null hypothesis is not rejected and a conclusion is made that teachers attitudes towards ICT do not significantly influence student achievement in mathematics.

4.6 Influence of availability of ICT equipment on student achievement in mathematics

Objective three sought to establish the level of availability of ICT resources in schools. This was based on a scale of: Very Available-1, Available-2, Not Sure-3, Sometimes Available-4, and Not Available 5

Table 4.11: Descriptive Statistics on the availability of ICT resources in schools

ICT device	N	Min	Max	Mean	Std. Dev
Computers	30	1	5	2.20	1.215
Projectors	30	1	5	1.33	1.269
Smart Boards	27	1	5	4.15	2.461
Word processors	27	1	5	4.78	2.063
Digital Sound System	27	1	5	3.85	2.476
VCD/DVD Players	28	1	5	3.21	2.485
Spread sheet Programs	28	1	5	4.50	2.117
Graphics Soft wares	28	1	5	4.96	1.895
Simulation Games	26	1	5	4.08	1.787
Internet Connection	28	1	5	3.96	2.502

As evidenced by the findings in table 4.11, most of the ICT devices are missing in schools. These include smart boards (4.15), word processors (4.78), Spreadsheet programs (4.5), Graphic soft-wares (4.96), and Simulation games (4.08). This is according to the high means which indicate that most teachers indicated that the resources were totally lacking. Internet connections (3.96), DVD/VCD players (3.21) and digital sound systems (3.85) were moderately rated meaning that they were partially available. The only devices that feature prominently in schools appear to be projectors (1.33) and computers (2.20). When the principals were asked whether the ICT resources in their schools were adequate for teaching,

62.5% said no while the rest (37.5%) responded otherwise. The shortage of ICT resources in schools is detrimental to the quest for ICT integration in teaching and learning in schools. Concerted efforts need to be put in place to ensure that quality teaching and learning is not compromised. One of the teachers interviewed had the following to say, 'I think it's our job as teachers to be quite conservative in just how much and how well we educate the students using the ICT equipment and technology'. The impression here is of conformity to external regulations severely undermining the use of ICTs in the teaching and learning processes.

In order to establish the relationship between the availability of ICT resources and student achievement in mathematics, chi square of independence was done to test linear association between the availability of ICT and student achievement. Table 4.12 below presents the test statistic obtained

Table 4.12: Chi-Square Tests of independence

	Value	**Df**	**Asymp. Sig. (2-sided)**
Pearson Chi-Square	59.677[a]	63	.596
Likelihood Ratio	43.244	63	.973
Linear-by-Linear Association	4.780	1	.029

n=30

From table 4.12, the linear-by-linear association between the variables is significant at 0.029 ($p<0.05$) hence the null hypothesis is rejected implying that the

availability of ICT and student achievement are not independent of each other. This implies that the availability of ICT resources positively influence student achievement in mathematics. This is in agreement with findings from studies by Luu and Freeman (2011); Kubiatko and Vlckova (2010) which found that computer availability and use had positive effects on students' achievement. Similarly, Wenglinsky (2004) surveying U.S. schools also found a positive relationship between the availability of ICT and student scores. Egwali (2009) further suggested that, the availability and proper utilization of ICT equipment by capable ICT professional educators is paramount to their impact on the achievement of students in a subject. This implies that it is critical to develop teacher skills in using ICT resources in order to improve student learning outcomes

4.7 Influence of teacher competence on ICT and students' achievement in mathematics

Objective four sought to determine the influence of teacher competence on ICT use, and student achievement in mathematics. To do this, the teachers were first asked whether or not they utilized the available ICT resources in the teaching and learning of mathematics. 46.5% of them said they used while 53.5% said No. The principals gave a similar opinion as 62.5% of them thought that teachers did not utilize ICT in teaching while 37.5% thought otherwise. The teachers who said they used them were further asked to indicate the frequency to which they used. This

was on a scale of Very often-5, Often-4, Sometimes-3, Rarely-2, and Never-1. Table 4.11 presents the descriptive statistics obtained

Table 4.13: Descriptive statistics on the level of use of ICT resources by teachers

ICT device	N	Min	Max	Mean	Std. Deviation
Computers	26	1	5	2.81	1.021
Projectors	24	1	5	2.79	1.141
Smart Boards	21	1	4	2.05	.973
Word processors	21	1	5	2.43	1.248
Digital Sound System	21	1	5	2.29	1.189
VCD/DVD Players	21	1	5	2.71	1.309
Spread sheet Programs	18	1	5	2.67	1.328
Internet	22	1	5	2.32	1.393

Table 4.13 shows that teachers rarely use the available ICT resources in the teaching of mathematics. This is characterized by the means of the responses which revolve around 2.0 meaning that the teachers responded in favour of ‘rarely’ or ‘sometimes’. The findings confirm the report by World Links program (2015) that relatively few teachers are integrating ICT into subject teaching in a way that motivates students and enriches learning or stimulates higher-level thinking and reasoning.

The study further sought to establish the level of competence of the teachers on the use of ICTs in teaching. The teachers were asked to respond to statements touching on competence which were Likert in nature, and based on the scale of Strongly Agree (SA), Agree (A), Undecided (U), Disagree (D), and Strongly Disagree (SD). Table 4.14 presents the findings

Table 4.14: Descriptive statistics on competence of teachers on ICT use

Statement	N	Min	Max	Mean	S.D
I can install education software in a computer	28	1	5	2.04	1.071
I can download materials from the internet	29	1	5	1.45	.910
I can produce PowerPoint presentation	30	1	5	1.70	.915
I can take photos using digital devices	30	1	4	1.43	.728
I can comfortably locate and retrieve curriculum resources in the internet	30	1	5	1.70	1.022
I know which teaching/learning situations require the use of ICT	30	1	4	1.77	.935
I can use computer spreadsheet to assess and evaluate my students	30	1	5	1.87	1.042
I can file documents computer folders	30	1	4	1.53	.860
I can produce simulation and use them in teaching	30	1	5	2.20	1.324

Table 4.14 shows that teachers can perform most of the operations that require the use of ICT devices. These include; downloading of materials (1.45), production of power point presentations (1.70), capturing and uploading photos using digital cameras (1.43), locating and retrieving of curriculum content (1.70), identification and classification of devices based on use (1.77), use of spreadsheets for student evaluation (1.87), and storage of material in computers (1.53). Similarly, they can also produce teaching simulations (2.20) and install soft wares in a computer (2.04). This generally suggests that, most teachers are competent in the use of ICT resources in teaching; hence the lack of use of the available ICTs could be attributed to scarcity or school policies.

In light of the above findings, teachers were asked to give their suggestions on what need to be done to ensure that teachers integrate ICT in the teaching and learning of mathematics. Table 4.15 summarizes the responses obtained

Table 4:15 Opinions on ways of ensuring that teachers integrate ICT in teaching of mathematics

Strategy	Frequency	Percent
sensitize teachers on importance of ICT	17	56.7
making computer studies compulsory in schools	1	3.3
Train teachers on use of ICTs	6	20.0
Increase ICT resources in schools	6	20.0
Total	**30**	**100.0**

From Table 4.15, 56.7% of teachers propose that teachers be sensitized on importance of ICT in teaching. 20% of them advocate for the training of teachers on the use of ICTs and the increase ICT resources in schools respectively. The remaining 3% want computer studies to be made compulsory in schools. On their part, 62.5% of the principal want more ICT resources to be provided in schools while 37.5% suggest that teachers be trained on how to integrate ICTs in the teaching learning process. According to the principals, 62.5% of the teachers are incompetent in the use of ICT in teaching hence the need for training on effective integration.

To establish the relationship between teachers competence in ICT and student achievement, chi square of independence (Mantel-Haenszel chi-square) statistic as presented in table 4.16

Table 4.16: Chi square analysis of independence

	Value	**Df**	**Asymp. Sig. (2-sided)**
Pearson Chi-Square	94.878[a]	88	.289
Likelihood Ratio	75.514	88	.826
Linear-by-Linear Association	.053	1	.818

N=30

The analyses indicate no significant relationship between teacher competence in ICT and student achievement in mathematics (i.e. they are independent of each

other). Based on this, the null hypothesis is not rejected and a conclusion is made that student achievement in mathematics is not related to teacher competence in ICT.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

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

5.2 Summary

The aim of the study was to establish the influence of information and communication technologies (ICTs) on student's performance in mathematics in public secondary schools in Dadaab sub-county, Garissa County. The objectives of the study were: i) To establish the influence of teaching method on students' achievement in mathematics in public secondary schools ii)To determine the influence of teachers' attitude towards ICT on students' achievement in mathematics in public secondary schools, iii) To establish the influence of availability of ICT equipments on students' achievement in mathematics in public secondary schools and, iv) To establish the relationship between teacher competence on ICT and students' achievement in mathematics in public secondary schools. The study targeted all head teachers, mathematics teachers and students in all public secondary schools in Daadab Sub-County.

5.2.1 Influence of teaching method on students' achievement in mathematics

Through data analysis, the study established that majority (70%) of teachers often applied traditional methods in the teaching of mathematics as opposed to the use of ICT. This meant that teachers were yet to fully embrace the integration of ICT's in the teaching of mathematics in public secondary schools in Dadaab sub-county. However, majority (87.5%) of teachers and principals believe that ICT methods contribute to better student achievement as compared to traditional methods. The study also established that positive correlations exist between teaching methods and student achievement in mathematics. ICT was strongly correlated to student achievement than traditional methods; this implies that ICT is a better determinant of student achievement compared to traditional methods. However the two methods were found to be associated to each other meaning that in order for a teacher to optimize student achievement in mathematics; he/she should use both methods complimentarily. The study further identified significant differences in the mean achievement of students taught using ICT and those taught using traditional methods, this means that the use of ICT in the teaching of mathematics significantly influence students achievement in mathematics. Based on this finding, the null hypothesis that the teaching methodology does not significantly influence student achievement was rejected.

5.2.2 Influence of teachers attitude towards ICT on student achievement in mathematics

The study established that, teachers generally had positive attitudes towards the use of ICT's in the teaching of mathematics. Generally, teachers found ICT resources useful; but more specifically, youthful teachers are more enthusiastic toward ICT use but as the age advances, that enthusiasm reduces. However, no gender variations were observed between the age of the teachers and their attitudes towards ICTs as both male and female teachers found ICT resources useful in teaching. This is very important because for teachers to effectively integrate ICT resources in the teaching-learning process, they have to first of all embrace them.

Furthermore, majority of the respondents were in agreement that ICT resources helped them organize their work; made subject matter in mathematics more interesting; saved on time and energy; increased teacher productivity and positively enhanced student achievement. However, they would prefer to blend both methods during teaching as opposed to using a particular approach at a time. This was in order because researches have shown that, in order for teachers to optimize learning outcomes, they ought to use both methods concurrently in the teaching learning process. From the results of linear-by-linear association statistic of the chi square analysis, no asymptotic relationship was found between teacher attitudes towards ICT and student achievement in mathematics. As a result, the

null hypothesis was not rejected and a conclusion was made that teacher's attitudes towards ICT do not significantly influence student achievement in mathematics.

5.2.3 Influence of availability of ICT equipment and student achievement in mathematics

The third objective of the study was to determine the relationship between the availability of ICT equipment and student achievement in mathematics. Through data analysis, the study found that most of the ICT devices including smart boards, word processors, spreadsheet programs, graphic soft wares, and simulation games were missing in schools. Other devices such as internet connections, DVD/VCD players and digital sound systems were available but not adequate. The only devices that appeared to be available in most schools were computers and projectors.

The shortage of ICT resources in schools is detrimental to the quest for ICT integration in teaching and learning in schools. Concerted efforts therefore need to be put in place to ensure that adequate ICT resources are availed in schools to assist teachers deliver the content efficiently and effectively. In so doing, student achievement in mathematics will also improve. A linear-by-linear analysis based on the chi square of independence revealed that significant relationship existed between students' achievement in mathematics and availability of ICT resources in

schools. This implies that, the availability of ICT and student achievements are not independent of each other but are linearly associated.

5.2.4 Relationship between teacher competence on ICT and students' achievement in mathematics

The fourth and final objective of the study was to establish the relationship between teacher competences in ICT and student academic achievement in mathematics. The study established that majority (62.5%) of teachers rarely used the available ICT resources in the teaching of mathematics.

On the competence of teachers on the use of ICT resources in teaching, the study revealed that majority of teachers (70%) can perform most of the operations including downloading of materials, production of power point presentations, capturing and uploading photos using digital cameras, locating and retrieving of curriculum content, use of spreadsheets for student evaluation and storage of materials in computers. Furthermore, teachers sometimes produced teaching simulations and installed soft wares in a computers. This implies that teachers are generally competent on the use of ICT resources in teaching; hence, the lack of use of the available ICT's could be attributed to scarcity of the resources in schools. The results of chi square of independence revealed no significant relationship between teacher competence in ICT and student achievement in mathematics (i.e. they are independent of each other). Therefore, this implied that student achievement in mathematics is not dependent on teacher competence in ICT, hence the null hypothesis was not rejected.

5.3 Conclusion

The empirical results from this study clearly indicate that the use of ICT resources in the teaching and learning of mathematics positively influenced academic performance in mathematics. ICT has a profound influence on process of teaching and learning as it offers new possibilities and chances for teachers and learners to explore new ways of dealing with abstract concepts in mathematics. It is important to note that factors like availability of ICT resources significantly affect performance and therefore the results suggests that there is need to invest heavily on ICT's resources through purchasing these tools and equipment. The unavailability of most of the ICT resources in schools is therefore detrimental to student achievement as the students are deprived of the opportunity to blend them with other methodologies in class to enhance their learning outcomes. Through the use of ICT resources will enable students to acquire new skills and competencies necessary that can make them improve their performance in mathematics besides making learning interesting. Teachers therefore must improve the frequency of use of ICT's in their lessons because study findings have revealed that they are having the requisite capabilities to perform basic operations involving the use of ICT resources, this will reinforce the traditional methods of teaching and bring about stimulus variation in the learning environment.

A more elaborate and collaborative approach and intervention of school administration can cause a change of attitude of the students towards the learning of mathematics. The study therefore underpins the availability of ICT's and the

methodology of teaching as the key influencers of learning and consequent achievement of students in mathematics.

5.4 Recommendations

Based on the findings, the study makes the following recommendations

5.4.1 Recommendations for policy

1. The government, through the ministry of education should ensure that ICT resources in schools are adequate in order for teachers and students to access and utilize them in the teaching and learning process. This can be done through the establishment of computer laboratories and resource centres in schools
2. The government, in conjunction with school administration should organize forums where teachers can be sensitized on importance of ICT in teaching. Backed up with evidence on the influence of ICTs on academic achievement, this can go a long way in ensuring that teachers embrace ICTs and use them more frequently in teaching.
3. School management need to make the computer studies compulsory to all students in form one and two so that students can acquire basic skills on the use of ICTs for educational purposes.

5.4.2 Recommendations for further research

The study recommends that further research be done on;

1. The gender parities on student achievement in mathematics in secondary schools
2. The perceptions of students towards the use of ICTs in the teaching and learning of mathematics.

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APPENDIX I: LETTER TO RESPONDENTS

Dear Respondent,

RE: REQUEST FOR PARTICIPATION IN DATA COLLECTION

I am a Post Graduate Student at Machakos University, pursuing a Master's degree in Educational Communication Technology in the School of Education. As part of the course requirement, I am currently carrying out a research on ***"Influence of ICT on students' academic performance in teaching and learning of Mathematics in secondary schools in Dadaab sub-county, Garissa County"***. For this purpose therefore, your school has been sampled for the study and some of your student's will also participate in the research. The School principal and mathematics teachers will be selected as respondents. Please help answer the questions as truthfully as possible.

The results of this study will be used for academic purposes only, and will be treated with the confidentiality that it deserves. I kindly request for your co-operation and support!

Yours Faithfully,

Joel Silla Muema.

E55-6647-2015

APPENDIX II: QUESTIONNARE FOR MATHEMATICS TEACHERS

SECTION A: **Teacher's Bio Data**

1. Please indicate your gender

   Male [ ]

   Female [ ]

2. Tick your appropriate age bracket

   Below 30 years [ ] 30 – 34 [ ]

   35 – 40 [ ] 41– 50 [ ]

   Above 51 years [ ]

3. What is your highest academic qualification?

   KCSE [ ]

   Diploma [ ]

   Degree [ ]

   Any other (specify)…….

SECTION B: Teaching Methodology and Student Achievement in Mathematics

4. Comparing traditional methods of teaching to ICT in teaching, which one do you think contributes to better student achievement in mathematics?

a) Traditional Methods [ ]

b) ICT [ ]

5. How often do you apply the following methods in the teaching of mathematics in your school?

Method	Very Often	Often	Sometimes	Rarely	Never
Pure Traditional Methods					
ICT Integrated methods					

6. How can you rate the achievement of your students in mathematics?

i) Excellent [ ]

ii) Good [ ]

iii) Average [ ]

iv) Below average [ ]

v) Poor [ ]

7. In your own opinion, what needs to be done to ensure that teachers integrate ICT in the teaching of mathematics

……

…….....

.....

.....

.....

SECTION C: Attitudes of Teachers towards ICT

8. What is your perception towards the use of ICT resources in the teaching and learning of mathematics?

(a) Very useful [ ] (b) Useful [ ]

(c) Not useful [ ] (d) Neutral [ ]

9. The table below contains items on attitudes of teachers towards ICT. Indicate your level of agreement or disagreement by placing a tick (√) against any of the following options:

Strongly Agree (**SA**), Agree (**A**), Undecided (**UN**) Disagree (**D**), strongly disagree (**SD**)

No	QUESTION	RESPONSE				
	PART ONE	**SA**	**A**	**UN**	**D**	**SD**
(a)	ICT resources help me organize my work					
(b)	Using ICT tools would make the subject matter more interesting					
(c)	Using ICT tools in teaching saves time and effort					
(d)	ICT makes me much more productive in my teaching					

(e)	Computers can positively enhance student learning					
(f)	I would rather use conventional methods than use ICT's in teaching					
(g)	I enjoy using ICT tools in teaching					
(h)	I hate using ICT tools in teaching because I fear embarrassment					

SECTION D: **Availability of ICT Equipment in Schools**

10. The table below provides some ICT resources used for teaching and learning. state their extent to which they are available in your school

Scale: Very Available (VA), Available (A), Not Sure (NS), Sometimes Available (SA), and Not Available (NA)

ICT Resource	VA	A	NS	SA	NA
Computers					
Projectors					
Smart boards					
Word processors					
Digital sound systems					
VCD, DVD players					
Spreadsheet programs					

Graphics software					
Simulations and games					
Internet connections					
Electronic Mail					

11. Other than the ICT tools listed in the table above, name any other ICT tools for teaching and learning available in your school

……

……

Section E: Competence of Teachers on use of ICT

12. Do you use the above mentioned ICT tools in the teaching and learning of mathematics?

    Yes ( ) No ( )

13. If Yes, how often?

ICT Tool	**Never**	**Rarely**	**Sometimes**	**Often**	**Very Often**
Computers					
Projectors					
Smart boards					
Word processors					
Digital sound systems					
VCD, DVD players					

Spreadsheet programs					
Electronic Mail					

14. If No, why?

……

……

15. The table below presents statements on some of the competence skills of teachers on ICT. Respond on each statement against the scale provided below.

Scale: Very True (**VT**) True (**T**) Can Try (**CT**) Can't Tell (**CT**) Not at All (**NA**)

Statement / Response	Strongly agree	Agree	Undecided	disagree	Strongly disagree
I can install education software in a computer					
I can download materials from the internet					
I can produce PowerPoint presentations					
I can take photos using digital devices and show them to students					

in the computer					
I can comfortably locate and retrieve curriculum resources in the internet					
I can prepare lessons that involve the use of ICT					
I know which teaching/learning situations require the use of ICT					
I can use computer spreadsheets to assess and evaluate my students					
I can file documents in electronic folders in the computer					
I can send electronic mail via the internet					
I can produce simulations and use them in teaching					

APPENDIX III: INTERVIEW SCHEDULE FOR THE PRINCIPALS

1. How can you rate the achievement of students in mathematics in your school?

   ……

2. Comparing traditional methods of teaching to ICT in teaching, which one do you think contributes to better student achievement in mathematics?

   ……

   ……

3. Do you have adequate ICT resources for teaching in your school

   .....……

   ……

4. Do teachers in your school optimize the available ICT tools in the teaching and learning of mathematics?

   ……

   ……

5. In your own opinion, what is the general attitude of teachers towards the use of ICT's in the teaching?

   ……

   ……

6. From your own assessment, would you say that teachers in your school are competent enough in the use of ICT's in teaching?

   ……

   ……

7. In your own opinion, what needs to be done to ensure that teachers integrate ICT in the teaching of mathematics

   .....

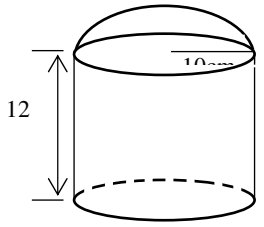
   .....

APPENDIX IV: MATHEMATICS ACHIEVEMENT TEST (Total marks 50)

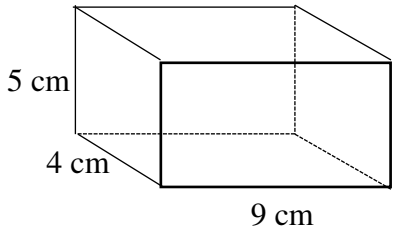
1. The corresponding lengths of two similar photographs are 12cm and 30cm. the Area of the larger photocopy is $750cm^3$. Find the

   a) Area scale factor
   b) Area of the smaller photograph.

2. Find the surface area of cylinder whose one side is spherical with radius 10cm and height 12cm.
   (4marks)

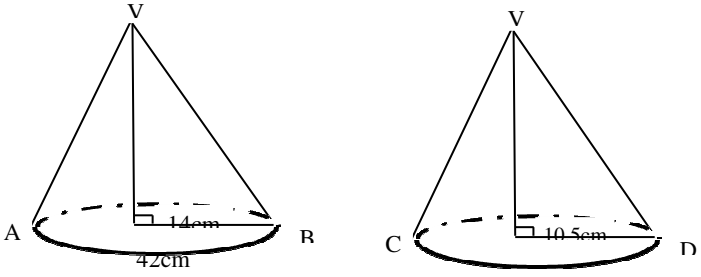


3. Find the surface area of the cuboid below.
   (4marks)

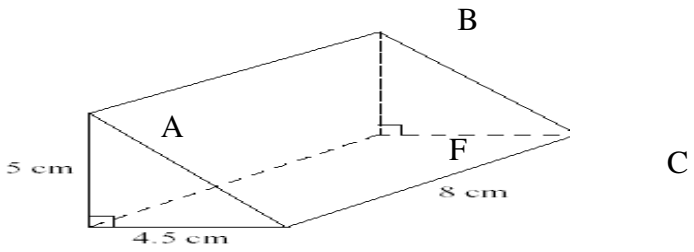


4. In figure below, VAB, VCD and VEF are similar cones. Their radii are 10.5cm and 7cm respectively. If the height of VAB is 4.2cm, calculate

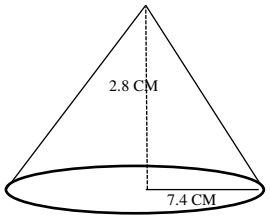
   a. Their height of the cones VCD
   b. (i). The ratio of the curved surfaced Areas of cones VCD and VEF
      (ii).The ratio of their volume



5. Find the surface area of the prism ABCDEF in figure 1.1 below(5marks)

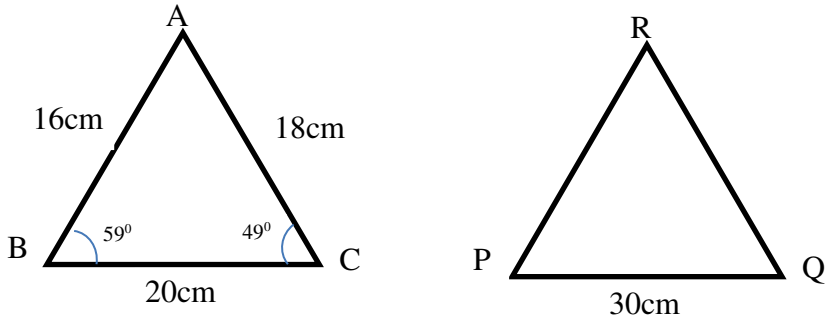


6. Find the surface area of a cone whose base is radius 2.8cm and height 7.4cm(5marks)

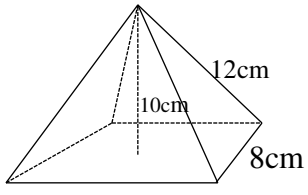


7. Given the triangles ABC and PQR in the figure below are similar. Find

   a. The size of LQPR
   b. The length of PQ and PR



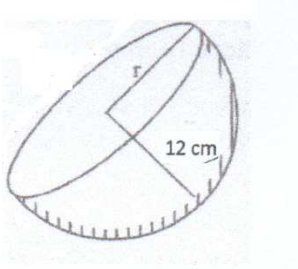
8. a). A right pyramid has a square base of side 8cm. If its height is 10cm and the slant height is 12cm, find its surface area. (fig1.3)
   (5marks)



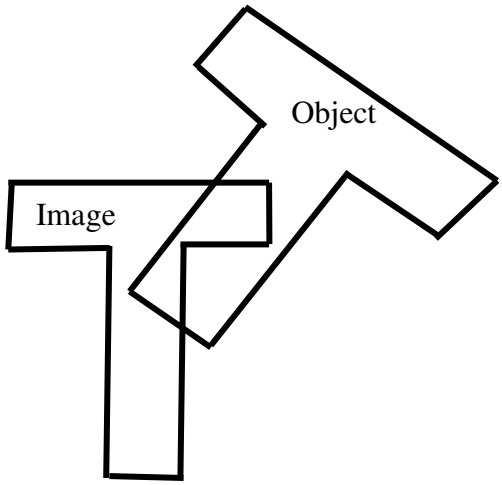
b) .Find the co-ordinates of the vertices of the image of a parallelogram whose vertices are A (3, 5), B (7,5), C (5,0)and (1,0) when rotated about the origin through.

a. -90^0
b. 180^0

9. A hemispherical bowl has a radius of 12cm, calculate its surface area. ($\pi=\frac{22}{7}$) figure 1.4 below. (5mks)



10 .The diagram below represents an object and its image after a rotation. Copy and find the centre and angle of rotation.



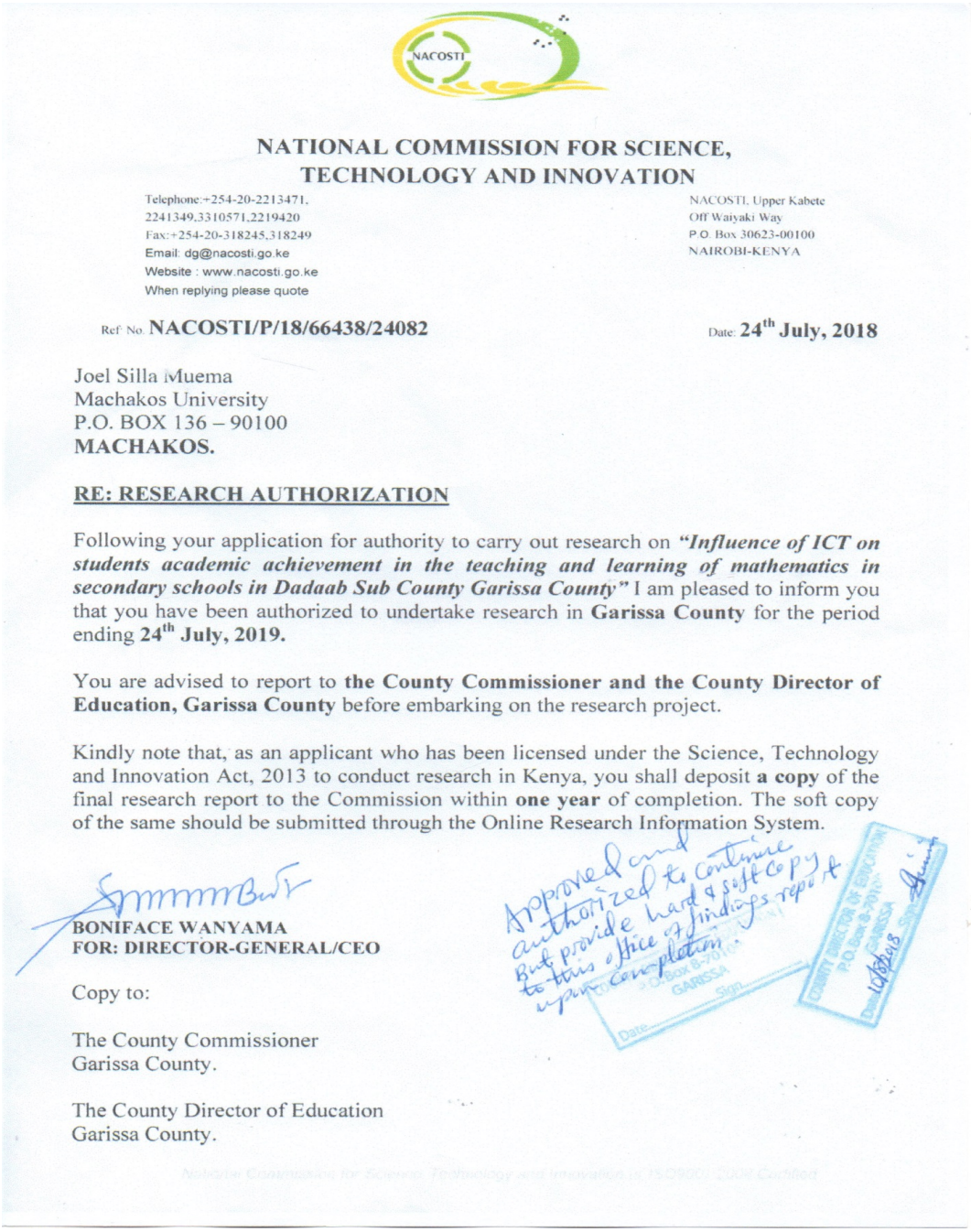
APPENDIX V: WORK PLAN

Month	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
Proposal writing										
Submission, Proposal defense										
Pilot study and Data collection										
Data analysis and presentation										
Report writing										
Report defense and sharing findings										
Submission of final report and defense										

APPENDIX VI: STUDY BUDGET

Item Description	Cost (ksh)
data collection – secondary data – Groups treatment/teaching – Transport and consulting with the project supervisors. – Pilot testing of instrument – Research assistance allowance – Questionnaire administration **Subtotal**	15,000 23,000 15,000 18,000 7,000
Purchase of consumables	**Ksh.78,000**
– Writing materials / pens – Computer photocopying service – Flash /compact disks **Subtotal**	1,000 8,500 5,000 **14,500**
Computer services – Typing – Photocopying /Printing – SPSS data analysis **Subtotal**	7,000 12,000 16,000 **35,000**
Final project report – Binding expenses	13,000
GRAND TOTAL	**Kshs 140,500**

APPENDIX VII: RESEARCH PERMIT



NACOSTI

NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

Telephone:+254-20-2213471, 2241349,3310571,2219420
Fax:+254-20-318245,318249
Email: dg@nacosti.go.ke
Website : www.nacosti.go.ke
When replying please quote

NACOSTI, Upper Kabete
Off Waiyaki Way
P.O. Box 30623-00100
NAIROBI-KENYA

Ref: No. **NACOSTI/P/18/66438/24082**

Date: **24th July, 2018**

Joel Silla Muema
Machakos University
P.O. BOX 136 – 90100
MACHAKOS.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on ***"Influence of ICT on students academic achievement in the teaching and learning of mathematics in secondary schools in Dadaab Sub County Garissa County"*** I am pleased to inform you that you have been authorized to undertake research in **Garissa County** for the period ending **24th July, 2019.**

You are advised to report to **the County Commissioner and the County Director of Education, Garissa County** before embarking on the research project.

Kindly note that, as an applicant who has been licensed under the Science, Technology and Innovation Act, 2013 to conduct research in Kenya, you shall deposit **a copy** of the final research report to the Commission within **one year** of completion. The soft copy of the same should be submitted through the Online Research Information System.

Approved and authorized to continue but provide hard & soft copy to this office of findings report upon completion

COUNTY DIRECTOR OF EDUCATION P.O Box 70-70100 GARISSA Date 10/8/2018

BONIFACE WANYAMA
FOR: DIRECTOR-GENERAL/CEO

Copy to:

The County Commissioner
Garissa County.

The County Director of Education
Garissa County.

National Commission for Science, Technology and Innovation is ISO 9001: 2008 Certified

APPENDIX VIII: RESEARCH AUTHORISATION

THE PRESIDENCY

MINISTRY OF INTERIOR & CO-ORDINATION OF NATIONAL GOVERNMENT

Telegrams: "COUNTY" GARISSA.
Telephone: Garissa
ccgsacounty@gmail.com

OFFICE OF THE
COUNTY COMMISSIONER
P.O BOX 1-70100
GARISSA COUNTY

When replying please quote

REF.NO: CC/EDU/7/3/(111)

10 August, 2018

Joel Silla Muema
Machakos University
P. O. Box 136-90100
MACHAKOS

RE: RESEARCH AUTHORIZATION

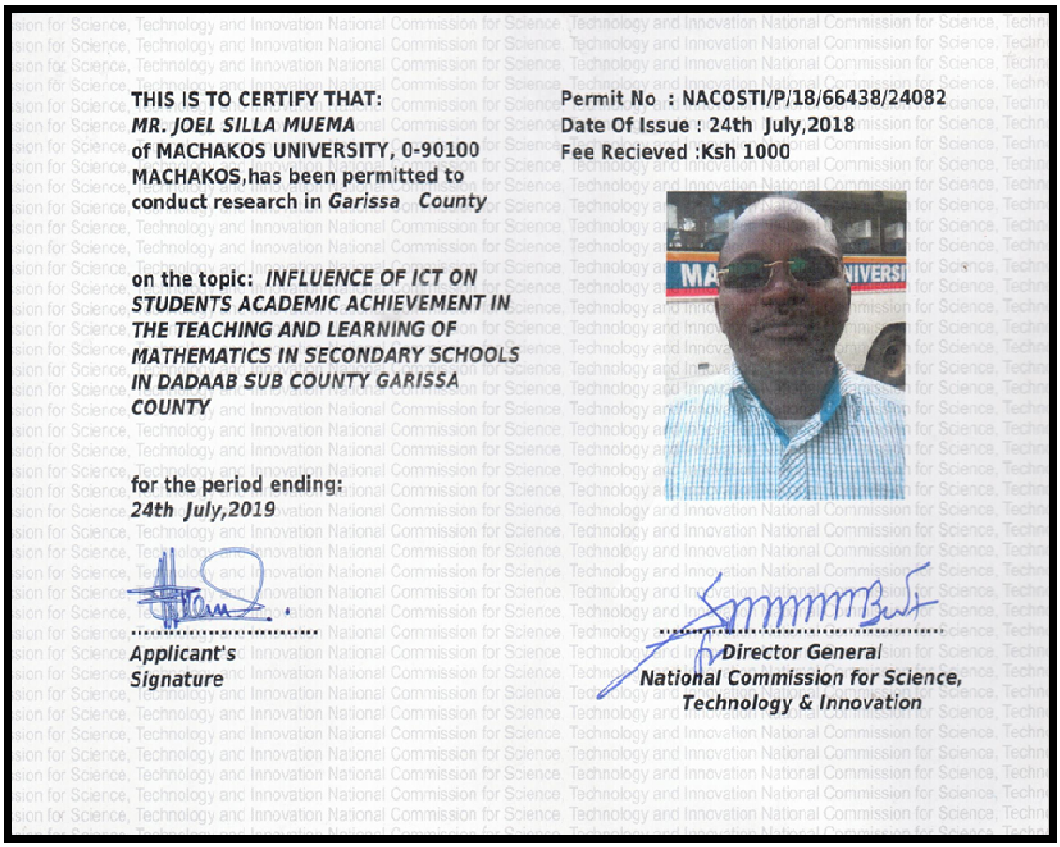
Refer to your letter Ref. No. NACOSTI/P/18/66438/24082 dated 24th July, 2018 from Director General/CEO on application for authority to carry out research on "***Influence of ICT on students' academic achievement in the teaching and learning of mathematics in secondary schools in Dadaab Sub-County Garissa County")*** in Garissa County for the period ending 24th July, 2019.

I am pleased to inform you that you have been authorized to undertake your research in Garissa County.

R. N Mbuli
For: County Commissioner
GARISSA COUNTY.

COUNTY COMMISSIONER GARISSA
P. O. Box 1-70100,
Email:ccgsacounty@gmail.com

APPENDIX IX: RESEARCHER'S PHOTO



THIS IS TO CERTIFY THAT:
MR. JOEL SILLA MUEMA
of MACHAKOS UNIVERSITY, 0-90100
MACHAKOS,has been permitted to
conduct research in *Garissa County*

on the topic: *INFLUENCE OF ICT ON STUDENTS ACADEMIC ACHIEVEMENT IN THE TEACHING AND LEARNING OF MATHEMATICS IN SECONDARY SCHOOLS IN DADAAB SUB COUNTY GARISSA COUNTY*

for the period ending:
24th July,2019

Permit No : NACOSTI/P/18/66438/24082
Date Of Issue : 24th July,2018
Fee Recieved :Ksh 1000

Applicant's Signature

Director General
National Commission for Science, Technology & Innovation

APPENDIX X: MAP OF DADAAB SUB COUNTY