PREPAREDNESS OF INFORMATION COMMUNICATION AND TECHNOLOGY INTEGRATION IN MATHEMATICS TEACHING: A CASE FOR PUBLIC SECONDARY SCHOOLS IN KIAMBU COUNTY, KENYA

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

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DEDICATION

This research work is dedicated to my dad William K. Changtoek, my Mum Serah C. Chebusit, my siblings Joan Chepkorir, Salome Chepkemoi, Isaac Kimutai and Abigael Chepkirui for their unwavering support spiritually, financially and emotionally. They have been encouraging me to push on in my academic progression despite the many ups and downs.
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<th>Abbreviation</th>
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<tr>
<td>CAS</td>
<td>Computer Algebra Systems</td>
</tr>
<tr>
<td>ICT</td>
<td>Information and Communication Technology</td>
</tr>
<tr>
<td>IT</td>
<td>Information Technology</td>
</tr>
<tr>
<td>KICD</td>
<td>Kenya Institute of Curriculum Development</td>
</tr>
<tr>
<td>MoE</td>
<td>Ministry of Education</td>
</tr>
<tr>
<td>PEOU</td>
<td>Perceived Ease of Use</td>
</tr>
<tr>
<td>PU</td>
<td>Perceived Usefulness</td>
</tr>
<tr>
<td>SPSS</td>
<td>Statistical Package for Social Sciences</td>
</tr>
<tr>
<td>TAM</td>
<td>Technology Acceptance Model</td>
</tr>
<tr>
<td>TRA</td>
<td>Theory of Reasoned Action</td>
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This study sought to investigate the preparedness of public secondary schools in Lari Sub-County to integrate Information and Communication Technologies (ICTs) in Mathematics teaching. The study was guided by the following specific objectives: to assess the availability of ICT infrastructure like computer laboratories, computer hardware and software programs for integrating ICTs in Mathematics teaching in secondary schools; to establish the teachers’ readiness in terms of skills and training for integrating ICTs in the teaching of Mathematics; to determine the teachers’ and students’ attitudes towards the use of ICTs in Mathematics instruction; and to establish the challenges the teachers are encountering in the integration of ICTs in the teaching of Mathematics in schools. The study employed a descriptive survey design to collect data in public secondary schools. The study targeted 35 head teachers, 85 Mathematics teachers and 2700 Mathematics students of public secondary schools in the Sub-County. Systematic sampling technique was used to select 12 schools from a list of 35 public secondary schools obtained from Lari Sub-County Education Office which accounted for 34% of the population. From the 12 sampled schools, all the 12 head teachers and all the 24 Mathematics teachers were purposively sampled to participate in the study. The students were selected through systematic sampling by use of Mathematics teacher’s progressive record book to ensure equal and fair representation of all students in the class. The total number of students in the sample was 360 (15%) of the population. Questionnaires and an observation schedule were used to collect data. The data obtained was entered into the Statistical Package for Social Sciences (SPSS) computer program after coding the responses. Data was analyzed quantitatively by using descriptive statistics such as frequencies and percentages. Qualitative data was obtained from the open-ended questions and analyzed according to themes based on the study objectives. Analyzed data was presented using tables and figures. The findings of this study revealed that public secondary schools in Lari Sub-County are poorly equipped with ICT facilities and equipment. Furthermore, most of the schools lack software, application programmes and digital content necessary for integration of ICTs in Mathematics. The following recommendations were made in this study: Education stakeholders in the county should finance the provision of ICT facilities and equipment in public secondary schools; All Mathematics teachers should be constantly trained to ensure that they get updated with new ICT skills; Government through KICD should develop a curriculum which will accommodate the integration of ICT in teaching and learning Mathematics; and lastly, the government through MoE, PTA and other educational stakeholders who finance free secondary education should allocate more tuition fees and encourage schools to have a specific vote head for computers so as to ensure reliable funding of computers by schools. Moreover, MoE should ensure efficient and effective use of funds to create sustainable computer programs in their schools.
CHAPTER ONE

INTRODUCTION

This chapter looks into the background of the study, statement of the problem, purpose of the study, objectives of the study, research questions, assumptions of the study, limitations of the study, delimitations of the study, significance of the study, theoretical framework, conceptual framework and operational definitions of terms.

1.1 Background to the Study

The 21st century education systems place high demands on Information Communication Technologies (ICTs) integration in teaching and learning processes. ICT has a great potential of changing how the learning process is carried out and the roles of learners and instructors in the learning process (Newhouse, 2002). Moreover, ICT can transform instruction from teacher-centred to a student-centred approach that enhances learner's understanding and critical thinking abilities. In classroom context, ICT integration entails technological approach to pedagogical processes. McNamara (2004) in his study of ICT incorporation in mathematics reported that ICT usage was found to enhance pupils' enjoyment of the lesson and obtaining good results.

ICT integration in Mathematics teaching and learning has been an area of interest for educators for a long time. The use of ICT has been associated with increased efficiency in Mathematical thinking. It also provides multiple ways of representing Mathematical concepts and enhances curiosity which may lead to invention (Borwein & Bailey, 2003).
In geometry and algebra, spreadsheets have been used in generalizing Pythagorean theorem (Abramovich, 1999). ICT application in mathematics also includes the use of portables, databases, and programmable toys.

Computer use in schools for teaching and learning has led to the belief that computer access could lead to higher academic performance and an advantage in the job market (Delen & Bulut, 2011).

The problem of effective ICT integration into the teaching of Mathematics is a complex innovation for teachers. They do not only need to have competent knowledge of teaching Mathematics but also need to be competent in the pedagogical use of ICTs in addition to having access to appropriate ICT tools (Voogt, 2008). Many studies have shown several obstacles that teachers experience in the integration of ICT in their classrooms. Jone (2004) found a number of barriers for the integration of ICT into lessons and listed them as: Lack of confidence among teachers during integration; Lack of access to resources; lack of time for the integration; lack of effective training; facing technical problems while the software is in use; lack of personal access during lesson preparation and the age of the teachers.

It is evident that all these barriers relate to ICT infrastructure, teachers’ skills to integrate the ICTs in the subject teaching and teachers attitude towards ICT use in instruction. This study seeks to access how public secondary schools in Lari sub-county are prepared with regard to integration of ICTs in the teaching of Mathematics.
In Kenya, ICT in education has been supported by NGOs such as the ICT Trust Fund which has provided a total of 4000 computers in 20 schools. Other organizations which have the ICT sector in education include NEPAD e-schools and The Rural School project. In addition, through Kenya Institute of Education (K.I.E), the government has developed e-content for enhancing curriculum delivery (ICWE, 2010). These efforts show government’s commitments in ICT inclusion in classroom instruction.

The government has also made efforts to encourage the uptake of computers by teachers through provision of loans by the Teachers Service Commission (T.S.C). Despite the aforementioned initiatives and efforts to enhance ICT usage in Kenyan public secondary schools and the fact that research has clearly shown that ICTs increase access to instructional materials and provides several other benefits that can enhance the teaching and performance of Mathematics, public secondary schools in Lari Sub-County of Kiambu County are still registering poor results in Mathematics examinations as shown in Table 1.1 below.

### Table 1.1: Lari Sub-County KCSE Exam Performance in Mathematics Subject from 2009-2013

<table>
<thead>
<tr>
<th>Year</th>
<th>Performance in Mean Score (Out of 12 points)</th>
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<tbody>
<tr>
<td>2013</td>
<td>3.36</td>
</tr>
<tr>
<td>2012</td>
<td>2.86</td>
</tr>
<tr>
<td>2011</td>
<td>2.99</td>
</tr>
<tr>
<td>2010</td>
<td>2.98</td>
</tr>
<tr>
<td>2009</td>
<td>3.128</td>
</tr>
</tbody>
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*Source: Lari Sub-county Education Office*
This study therefore sought to assess the preparedness of the schools to integrate ICTs in the teaching of Mathematics by investigating the availability of ICT infrastructure in the schools, teachers ICTs integration skills, teachers' and students' attitudes towards ICT integration in Mathematics instruction, and hindrances faced in the course of integration.

1.2 Statement of the Problem
Kenyan government has made many efforts to enhance students' performance in science and mathematics in national exams. Despite all these efforts, Lari Sub-County has continued to register poor performance in Mathematics. This has raised concerns about the institutions' readiness to adopt the strategies that have been identified as being capable of enhancing instruction and performance of the subject.

This study was concerned with the preparedness of the institutions to integrate ICT tools in the teaching of Mathematics because ICTs have been proven to enhance access to instructional materials that are crucial in the performance of the subject. Therefore, the study sought to investigate preparedness status of public secondary schools in Lari Sub-County to integrate ICTs in Mathematics teaching.

1.3 Purpose of the Study
This study endeavored to establish the preparedness of government sponsored secondary schools in Lari Sub-County to integrate ICTs in the teaching of Mathematics. Specifically, the study sought to establish the level of ICT integration in Mathematics and how it has contributed towards attitude change in both teachers and learners.
1.4 Objectives of the Study

This study was guided by the following objectives:

i. To assess the availability of ICT infrastructure for integrating ICTs in Mathematics teaching in the public secondary schools;

ii. To find out the teachers' readiness in terms of skills and training for integrating ICTs in the teaching of Mathematics in public secondary schools;

iii. To determine the teachers' and students' attitudes towards the use of ICTs in Mathematics instruction in public secondary schools; and

iv. To establish the challenges that the teachers are encountering in the integration of ICTs in the teaching of Mathematics in public secondary schools.

1.5 Research Questions

The study sought to answer the following research questions:

i. What is the status of ICT infrastructure for integration of ICTs in the teaching of Mathematics in public secondary schools?

ii. What is the status of teachers' readiness in terms of skills and training for integrating ICTs in the teaching of Mathematics in public secondary schools?

iii. What are the teachers' and students' attitudes towards the use of ICTs in Mathematics instruction in the public secondary schools?

iv. What challenges are the teachers encountering in the integration of ICTs in the teaching of Mathematics in public secondary schools?

1.6 Significance of the Study

The findings of the study are expected to be useful to the Sub-county and to the ministry of education at large in identification of barriers that limit the adoption of ICT by the public secondary schools for Mathematics instruction purposes. From the
findings, the level of ICT adoption in public secondary schools in Lari Sub-County will be established. This will help policy makers and planners in ICT policy formulation and implementation to revise the existing ICT policy to tackle the challenges affecting ICT adoption and use in schools in the country. The study will also contribute knowledge to the area of ICT integration in Mathematics teaching that can be useful to other scholars.

1.7 Scope of Limitations

The following were the limitations of the study:

i. No study on ICT integration in Mathematics has been conducted in Lari Sub-County. Most related data were from other districts and counties (ministry of education, D.E.Os office-Lari). The data from other sources helped to overcome this limitation.

ii. It was not possible to obtain the opinions of educational stakeholders outside the school.

1.8 Scope of Delimitations

i. The study was confined to government sponsored secondary schools in Lari Sub-County because they are beneficiaries of Ministry of Education computerization project.

ii. The study was delimited to a small sample of public secondary schools in Lari Sub-County due to financial and time constraints.
1.9 Assumptions of the Study

The following were the assumptions of the study:

i. All respondents responded to the questionnaire items with utmost honesty.

ii. The sample taken was a true representation of the whole students, teachers and administrators population in Secondary schools of Lari Sub-County.

iii. There was observable impact in the teaching of Mathematics.

1.10 Theoretical Framework

This study was informed by Technology Acceptance Model (TAM) developed by Davis (1989). TAM is derived from the theory of reasoned action (Ajzen & Fishbein, 1980) which explains how user's beliefs and attitudes relates to an individual’s intentions to perform. The theory of reasoned action (TRA) further explains that attitude towards a behavior is influenced by behavioral beliefs about the consequences of the behavior (based on the information available or presented to the individual) and the affective evaluation of those consequences on the part of the individual. Beliefs refer to individual's expectation that executing a particular behavior will result in a particular consequence.

The TAM model explains how users come to accept and use technology. TAM is comprised of two variables that are thought to be essential in determining user acceptance-Perceived Usefulness (PU) and perceived ease of use (Davis, 1989). Using TRA, TAM specifies the causal linkages between PU and PE, user’s attitudes, intentions and the actual computer adoption behavior. In the TAM model, TAM, PU and PE are the fundamental motivational variables for accepting and using new technologies. Davis (1989) modified this model to include other factors including
perceived ease of use, perceived usefulness, ICT usage, and attitudes towards ICT (Figure 1.1 shows the TAM).

The TAM hypothesizes that users develops positive attitudes towards technology when they see technology as useful and easy to use (Davis, 1989). PEOU explains the user's perception of the amount of effort required to utilize the system or the extent to which a user believes that using a particular technology will be effortless. Consequently, it is expected that educational technology with a high PU has a higher chance of inducing positive attitudes. Moreover, PU is related to PEOU in that PU mediates the effect of PEU on attitude (Moon & Kim, 2001). That is, whereas PU directly affect attitude, PE has an indirect impact on attitude through PU.

The theory was suited for the current study because it sought to investigate the preparedness of Public Secondary schools to integrate ICTs in the teaching of Mathematics which has been proposed as one of the strategies that can enhance availability of instructional materials that are crucial in improving the performance of the subject.

![Figure 1.1: Theoretical framework showing how an innovation is perceived and interpreted by the user](image-url)
1.11 Conceptual Framework

Research has consistently shown that ICT use in instruction improves learning in Mathematics and Science and also in other subjects that are abstract (Cox, et al, 2001). ICTs have also been said to increase access to instructional materials as well as support constructivist pedagogy.

Figure 1.2: Conceptual Framework Showing Impact of ICT integration in Mathematics Instruction

Source: Researchers' own design

The above conceptual framework shows that when ICTs infrastructure are availed, teachers ICT integration skills and their attitudes towards ICT use in Mathematics instruction improved; factors which are viewed as the independent variables (IV) are enhanced and supported by management support of ICTs and favorable ICT policies viewed as the intervening variables, then the performance of Mathematics in the public secondary schools can be enhanced through effective teaching of Mathematics which is the dependent variable study of the study.
1.12 Operational Definitions of Significant Terms

Computer  
a programmable machine used for storing and processing data.

E-readiness  
The state in which an institution is prepared to use and benefit from Information technology machinery.

E-Learning  
Means the ability to transfer electronically, manage, support and supervise learning.

Information Communication Technologies  
Are tools that allow digitized information technology

Infrastructure  
Includes computer software, hardware, and network connections.
CHAPTER TWO
LITERATURE REVIEW

2.0 Introduction

This chapter reviews literature on ICT. Specifically, the review is about topics on how ICT has been integrated in both learning and teaching. A lot of emphasis is placed on how ICT has been integrated into the teaching and learning of mathematics. Furthermore, this chapter has also highlighted the level of global E-readiness. A review of the attitude towards the use of ICT in the instruction of mathematics among teachers and students has been carried out. The chapter has concluded with a summary of the literature review.

2.1 Integration of ICTs in Teaching and Learning

Studies have shown that ICT has greatly influenced not only teaching but also learning in the field of education. Yusuf (2005) summarized benefits of the integration of ICT in both learning and teaching. According to him, the use of ICT has been very instrumental in the acceleration, deepening, and enrichment of skills of learners. Besides assisting in the motivation and engagement of students, Yusuf also found out that the integration of ICT can greatly contribute towards equipping learners with skills that help them when they are transitioning from schools to work. As a result, it facilitates the improvement of the viability for the future workforce in the economy. ICT has also transformed the way schools offer teaching by strengthening areas that were at first deemed weak. In a typical conventional teaching, a lot of the emphasis has been placed on content. The textbooks have been the basic mode of communicating written instructions for quite a length of time. On the other hand, learning instructors and teachers have been depending on both
presentations and lectures complemented with learning activities and tutorials which have been designed in alignment with the content. Unlike the traditional approach, contemporary settings are for a design where curricula is used as an avenue for promoting not just competency but also performance. Besides this, the modern approach places much emphasis more on the capabilities with a lot of concern in not just the nature of the information but how the information will be put to use. As a result, ICTs has been used as a means of facilitating this cause.

A study on the current global trends show that there exist some of the best examples of performance-based as well as competency-based settings of global standards which employ the use of ICTs (Oliver, 2000). Effective integration of ICT in the learning curriculum has been found to be one of the best ways of revitalizing both students and teachers. Such an integration further helps in the support of curricular particularly in subject areas which students deem difficult. In the process it facilitates the improvement and development of quality education.

Oliver (2000) observed that effective integration of ICT into the teaching and learning process allows for some flexibility of time and space results in the increased interaction between the learners and the teachers. He also found out that such an integration results in improved reception of information. With such possibilities comes the changes in the model of communication and the methods of teaching and learning utilized by instructors. These developments have given rise to a new set of scenarios that favor collaborative as well as individual learning. One other critical use of ICT tools has been to foster independent learning amongst the learners. Studies have shown that the introduction of ICT in a learning environment results in a more student-centered learning. It has also been found out that the technology
encourage cooperation in the learning environment. Furthermore, Newhouse (2002) contend that the introduction of ICT can be used to stimulate increased teacher-student interaction with further evidence suggest that teachers using ICT applications in their pedagogy have a greater chance of recording better gains on measures along progressive thought and reflection. The possibility of using ICT to foster cooperative work and less of teacher lecturing in schools that already has an integrated ICT is the fundamental basis of this study. Weller (2002) pointed out that such an integration affords teachers a chance to allow their students to be field independent (field independent learners are those learners who do not depend much on contextual clues in their process of defining meaning) and in the process helps them to record better performance when compared with their field dependent counterparts. Reeves and Jonassen (1996) view this type of learning as one that emphasize a case where learning purposes itself is immersed in the process of learning and with increasing number of students using ICT such as computers as cognitive tools and as sources of information, the technology increasingly contributes a lot in supporting the students methods of learning.

Conventionally, the process of teaching has always involved teachers planning and leading their students through a sequence of instructions with the objective of producing a desired outcome in mind. Typically, consolidation of the acquired knowledge has been effected by a process of planned transmission of a body of knowledge accompanied by interaction with the thought content. Duffy and Cunningham (1996) argued that contemporary learning theory is anchored on the idea that learning is an active process which involve constructing knowledge instead of just acquiring knowledge. They further pointed out that instruction involves a
process where knowledge construction is supported instead of just transmitting it. This view is supported by Janssen and Reeves (1996) who also suggested that learning is not just about memorization of facts but rather the construction of meaning. The integration of ICTs in contemporary approaches can be used to create many opportunities ideal for constructivist learning since they promote the provision as well as support for resource-based and student-centered settings. The other benefit of ICT integration is also to enable learners to relate context to practice (Barron, 1998).

In her study on the use of ICT in the education sector in Romania, Elina (2008) observes that 70% of the teachers preferred using computers to teach. The teachers suggest that they managed to register good performance when they used ICT to teach. Comments given by the students suggest that the approach makes learning process simpler and makes the understanding of the content easier.

2.2 Integration of ICTs in Mathematics Teaching and Learning

The significance of using technology to teaching and learning lessons like mathematics had been earlier noted by Ittigson and Zewe (2003). The researchers concluded that ICT helps in not only improving the method of teaching mathematics but also enhances understanding of the basic concepts of the content amongst the students. Becta (2003) also pointed out a number of key advantages of integrating ICTs in the teaching of mathematics. One advantage being the ability of the ICT to promote greater communication, knowledge-sharing and collaboration among students. The technology has also been found to facilitate teachers ability to provide fast and accurate feedbacks to learners which eventually leads to higher levels of motivation among the learners. Besides supporting constructivist pedagogy, the
other benefit is that it allows the students to concentrate on strategies of solving questions and interpretations of answers provided; thus save them time spend on tedious computational calculations. Technology helps students to explore and gain a better understanding of the concepts relevant to mathematics. Basically, this approach is ideal for the promotion of higher order thinking as well as better strategies to problem-solving; the key elements in the learning of mathematics.

Keong, Horani and Daniel (2005) pointed out that successful integration of ICT into the mathematics curriculum requires a thorough understanding of the current software that is to be developed for mathematics teachers. In a related study on teachers and the use of ICT, Forgasz and Prince (2002), reported that 30% use internet browsers, 61% use spreadsheets, and 45% used word processors. In a similar survey, evidence shows that 19% used a combination of CD-ROMs and mathematics textbooks while 19% used Geometer's sketchpads. A further 14% used Math Blaster, 18% using Graphmatica, and 8% using other softwares are specific to mathematics. The researchers, however, suggested that knowing the use of the software among the teachers is not the only basis for ICT integration in mathematics lessons. Instead, the authors pointed out that one of the critical success factor is a sound pedagogical knowledge on the process of integration. Three different use of technology has been described by Amarasinghe and Lambdin (2000). One of the reason they pointed out is the ability to save time. The other reasons include the ability to offer access to new robust methods to learners where they can deeply explore concepts; something which was not possible in the past.

Mathematics instruction can be fundamentally changed by the power of computer. This include tasks such as building and running complex mathematical models and
exploring such questions as 'what if' through parametric variation which has ushered in a new avenue for solving mathematics (Dreyfus, 1991). This benefit was noted by Munirah (1996) who observed that the teaching of calculus has been dramatically influenced by technology. For example, computer technology has revolutionized activities such as graphical data analysis and exploring Mata. Wimbish (1992) reported that technology can help weaker students to register higher rates of success, and thereby and thus encourage them that mathematics is not meant for their able counterparts.

2.3 E-Readiness Status of Schools

Statistics from the US Department of Education, USDE (1996) reveal that by the year 1996, 62% of the secondary schools in the USA were using advanced telecommunications, 91% were using computers while 73% had integrated ICT into their school curriculum. A survey carried out by Betty (1994) in Spain, shows that both primary and secondary schools has achieved a close to 100% penetration in IT especially in the urban areas. However, schools located in rural zones far from the urban areas are ill-equipped.

In a similar study, Gaible (2008), noted that introduction of ICT infrastructure in the Caribbean schools has the potential to make a valuable contribution to the education system since ICT is in a better position to offer effective response to policy goals as well as internal and external forces affecting the region today. As a result, survey shows that most secondary and primary schools offer learners an opportunity to access computers and in circumstances where the telecommunications systems allow, the students can also access internet. It is on the basis of these findings that several countries including Trinidad & Tobago, Jamaica, and Barbados
have embarked on ambitious programmes geared towards integration of ICT programmes in the education sector. However, the study also revealed that although computers and the internet has been widely deployed, it has had limited impact in both the primary and secondary education in their Caribbean countries. The most it helps is to serve as a basis for supporting students in the practical aspects of IT examinations. Some of the major barriers to effective utilization of ICT in the education sector in the region has been attributed to lack of enough capacity among the teachers, information management, the relevance of the curriculum, and the students’ competencies which have not been positively influenced even with the heavy investment in the ICT in the past decade.

In the context of education, Farrell and Shafika (2007) pointed out that ICT Infrastructure for education in Africa is not yet developed. They observed that most countries have already liberalized the telecommunication policies or they are in the process of liberalization. Liberalization is seen as an avenue for allowing diversity in provision of the services by the various companies. One of the barriers towards large-scale deployment of telecommunication services in Africa has been pointed out to be affordability. Many people cannot afford the high cost of connectivity.

Furthermore, there are huge gaps between urban and rural areas in terms of access to ICT infrastructure. For the case of infrastructure in schools, Farrell and Shafika (2007) observed that African Ministries of Education have begun to be more proactive in coordinating and leading the development of ICT infrastructure in schools system. On the other hand, the civil society in form of Non-Governmental Organizations (NGOs) has been also instrumental in the promotion of the use of ICTs in schools. These NGOs have been actively collaborating with donor agencies
to supply schools with computers. They also play a key role in lobbying governments to continue prioritizing the introduction of ICTs in schools. Regarding the professional development of teachers, the authors observed that most countries have invested substantially in the capacity building through a combination of pre-service and in-service programmes. It has also been noted that in training programmes for teachers in Africa involve the inculcation of basic ICT skills. Although this involve the application of ICT as an end in itself, in some instances it involves advanced methods where ICT is used as a application for not just learning but also teaching.

Investigations carried out previously in Kenya show that very few high schools had sufficient ICT infrastructure for both teachers and students. Even in schools that have invested in the technology, Farrel (2007) found out that the ratio of students to computers is as high as 150:1. This was corroborated by studies carried out by Wabuye (2003). Wabuye observed that despite the fact that ICT has penetrated almost every industry in Kenya including but not limited to transportation, banking, medical services, and communication, the Kenyan educational system is still far much behind. The results of the study suggested that computer use in Kenyan education system is still in its infancy stage. The study also concluded that besides perceptions, experiences of the adminstrations and teachers contribute a lot towards effective use of computers in the classrooms. Despite many schools knowing that there are a lot of benefits from computers, few of them have invested in the equipment.

One of the barriers that have been observed to contribute to effective deployment of ICT in Kenya’s education system is inadequate infrastructure and network
connectivity (Farrell, 2007). Nonetheless, a small percentage of schools have direct access to high speed connectivity offered by local internet service providers. Despite these challenges, Point (2008) pointed out that Kenya is the third country in Africa to embark on ambitious integration of ICT infrastructure in its education system. The program is sponsored by Intel and the objective is to equip school with not only computers but also wireless connectivity. Upon completion, the program will replace the traditional blackboard with touch screen which shall improve student-teacher interaction over wireless connectivity. Although there has been good progress, there is the challenge of deploying the infrastructure in remote rural which lack the basic infrastructure to support this type of learning.

2.4 Attitudes towards the Use of ICTs in Mathematics Instruction

Gagne (1985) defined as either an inclination to act or being in a state of preparedness to act. It is an outward behavior which is a manifestation of an inward feeling and has an effect on the teacher, the learner, and the social group associated with the individual learner. Learning experiences influences individual and group attitudes. Individuals may develop certain attitudes simply by doing what their role modes are doing which include friends, parents, and teachers. This is best described as mimicry (imitation) which is one of the fundamental factors to teaching and learning. In this regard the learner’s attitude is derived from his or her teachers’ disposition. The nature of the disposition may influence the learning. For example, a positive attitude only comes out as a result of either previous successful experiences or from a learner’s perception that success is possible. Davis et al (1989) came up with what is popularly known as Technology Acceptance Model (TAM) which show that intention by a learner to use a computer is directly influenced by his or her
attitudes towards the use of computer. The authors observed that individual's initial attitudes towards the ease of using computer and the usefulness of computer has a direct influence on his her attitudes toward the use of that computer. Training has been used to significantly improve the computer self-efficacy among females and males (Torkzadeh, Pflughoeft & Hall, 1999). They also reported that training programs seemed more effective for male and female respondents with positive attitudes toward computers.

According to Bandura (1971), individuals acquire behaviors by watching another or others (which can be the parent, the model, friend, teacher, and mentor) who perform the behavior. While the model does the display, the learner do the observation and subsequently tries to imitate what was displayed by the model. With regards to the teaching and learning mathematics, the beliefs of teachers about learning of the subject with or without applying the technology have been considered to be very important since they could be used to improve the teaching and learning as well as reforming of the curriculum (Schoenfeld, 1987). Schoenfeld argued that the beliefs among mathematics teachers can be regarded as individual perspectives on the way the teachers execute their mathematical tasks as well as pedagogical practices. Given that teachers hold certain beliefs regarding mathematics subject which easily influence the manner in which they teach or organize the learning environment, they as well hold beliefs regarding the use of technology to teach mathematics.

For example, Li (2007) and Kynigos and Argyris (2004) studied on the kind of beliefs teachers harbor on the use of ICT in a typical mathematics classroom. They found out the beliefs harbored by people can negatively affect the deployment of
the use of technology in teaching. The study further revealed that there exist contrasting set of beliefs between those of students and teachers' beliefs. Students interviewed suggested they are more happy to use the technology because it could afford them an opportunity to learn in a more efficient, and effective full of fun. This further shows that the technology can be a good means for increasing confidence levels among the weak students.

Studies also showed that no teacher regard the use of technology to be of any advantage to the traditional approach to the teaching of mathematics especially when it comes to the improvement of weak students. Kynigos and Argyris (2004) pointed out the various complexities that are central in the formation of beliefs and practices in classroom intervention by the teachers, the growing social roles and their influence on the education system and the school. The researchers also found out that kind of innovation to be used together with the exploratory software can influences a lot in the classroom mathematics activities.

ICT systems such as computer software and other associated technological tools require a strong knowledge and understanding of how they operate as well as the syntax and familiarity with the embedded functions. However, evidence suggest most mathematics teachers in Kenya do not have adequate proficiency in digital technologies to support the deployment of these technologies. Consequently, the emphasis ought to be on the improvement of the literacy skills in ICT. Furthermore, another thing that will support the integration of the technology in education system is to make sure that the teachers are confident in the application of the technology (Taylor and Corrigan, 2007).
2.5 Factors Inhibiting ICT Use in Mathematics Classrooms

There has been widespread investigation into the barriers of the deployment of ICTs in schools. According to Jones (2004), some of the barriers to the integration of ICT in classroom include low level of confidence among teachers; poor accessibility to resources; inadequate time for the integration; poor training; technical problems encountered during the use of software; absence of personal accessibility during times of lesson preparation; and the advancing age of the teachers. Other barriers identified by Snoeyink and Ertmer (2002) include absence or inadequate computers in schools, poor quality software, limited time, technical problems in use of equipment, attitudes of teachers towards computers, inadequate funding, low level of confidence among teachers, stiff resistance to change by those used to the traditional approach, lack of administrative support, absence of computer skills, inconsistent match with the curriculum, difficulties of scheduling, inadequate or lack of training opportunities on relevant skills, and lack of clear vision and know-how on integration of ICT as part of the instruction.

Previous studies conducted in Ghana shows that a combination of poor accessibility and low level of competency among pre-service and in-service teachers of mathematics teachers was associated with low levels of ICT integration. In addition, the study revealed that there is positive attitude towards the use of computers in schools. It was therefore suggested that there is a need to prepare new teachers to appreciate the flexible teaching methods that incorporate the use of ICT (Agyei and Voogt, 2008). Teachers’ preparation programmes are key to ICT integration. However, investigators have shown that teacher programmes lack the incorporation of technology in the method of teaching (Adamy and Boulmetis, 2016) or introduce
effective techniques for integration of the technology into single technology subjects (Brown and Warschauer 2006). Manoucherhi (1999) argued that lack of computer use is an indication of absence of experience as well as access to necessary software meant for educational purposes; inadequate or absence of professional training and absence of the necessary support in the use of computers in the teaching of mathematics. Studies by D’Sousa, Sabita and Woods (2003) and also by Palmer (2002) came up with similar findings. For example, one of the main barrier in the integration of technology in the classroom was lack of computers in the schools and absence of professional development and lack of access to computers. A number of solutions have been advanced for the effective deployment of the technology in the classrooms. Swan and Dixon (2006) suggested the need to put in place training programs for technology while Toumasis (2006) suggested the need to teach teachers the application of software packages. However, Sorkin et al (2004) advocated for the establishment of instructional strategies and lesson planning with full integration of in technology in the teaching of mathematics; ideas which were also shared by Hardy (2004). The need for a proper professional development was emphasized by Wells and Sprague (2007) while Sorkin et al further stressed the need to carry out effective training in software use including the need to consider teachers’ preferences regarding the liberty to choose their instructors.

2.6 Summary of Literature Review

The above literature review shows the use of ICT in the teaching of mathematics is increasingly becoming popular because of its effectiveness in the teaching of mathematics. The use of ICTs has also demonstrated that it has the ability to improve access to instructional materials while at the same time offer
necessary support to constructivist pedagogy. In constructivist pedagogy, the students utilize the technology to not only explore but also get to learn concepts used in mathematics. In this review, it was found that some countries have managed to build a strong base for the use of ICT in the field of education. Their success has largely been brought about by good e-strategies, heavy investment in ICT sector, and well-developed infrastructure. In Kenya, ICT is being introduced as a way of enhancing access as well as improving the quality of education. However, the review demonstrate that although there is an increasing emphasis and efforts towards the development of ICT based learning, performance in mathematics and science subjects has been declining. This is well demonstrated by previous results of national examinations. This has therefore raised the question of whether implementation of the suggested strategies is likely to make any meaningful impact in the teaching and performance of mathematics and science subjects. The purpose of this study is therefore to investigate the level of secondary schools' preparedness to integrate ICTs in mathematics teaching. This study will also investigate the availability of ICT infrastructure for ICT integration and the teachers' readiness in terms of skills and training for integrating ICTs in the teaching of Mathematics. In addition, the study will seek to determine the teachers and students' attitudes towards the use of ICTs and establish the challenges the teachers are encountering in the integration of ICTs in the teaching of Mathematics. Most studies done previously concentrated on e-readiness in education institutions in general and ICT constraints thus leaving a gap in knowledge about impact of ICTs integration on specific subjects.
CHAPTER THREE
RESEARCH METHODOLOGY

3.0 Introduction
This chapter discusses the processes that have been undertaken to achieve the objectives of the study by considering the research design, location of the study, target population and sample selection. Research instruments and their administration have also been described during piloting and actual data collection. Finally, data analysis techniques that have been used have been outlined.

3.1 Research Design
Descriptive survey design was employed in this study. The design was appropriated for this study because as noted by Borg and Gall (2003) descriptive survey research is aimed at producing statistical information about aspects of education that interest policy makers and educators. The study surveyed a sample of public secondary schools in Lari Sub-county of Kiambu County so as to describe their state of preparedness to integrate ICTs in Mathematics teaching.

3.2 Locale of the Study
Lari Sub-County is about 50 kilometers west of Nairobi. This Sub-County was selected because of the researchers own interest and knowledge of the area. Singleton (1993) observed that the ideal setting for any study is one that is directly related to the researchers own interests. Another rationale for choosing the Sub-County is that it has been hosting SMASSE programmes since the year 2009 where schools have been encouraged to integrate ICTs in the teaching and learning of Mathematics and Science as a strategy to help boost performance in the two areas.
The region is rural and is densely populated. It covers an area of 441.1 square kilometers. The terrain is hilly. The sub county is surrounded by four other Sub-Counties namely; Githunguri, Kiambu West, Nakuru and Nyandarua.

3.3 Target Population

The Sub-County has 35 public secondary schools. The current study targeted 35 head teachers, 85 Mathematics teachers and 2700 Mathematics students in Lari Sub-County. The head teachers were required to give the status of ICTs readiness in their schools; level of ICTs investment and the strategies in place to enhance ICTs integration in their schools. Teachers were required to give information on their preparedness as pertains to skills of integrating ICTs in Mathematics teaching, their attitudes towards the use of ICTs in Mathematics instruction, the students’ attitude towards ICT use in learning Mathematics and the hindrances that they are encountering in the integration of ICTs in the teaching of Mathematics in their schools. The students were required to give information pertaining to their attitudes and their level of participation towards the subject.

3.4 Sampling Techniques and Sample Size

A sample of at least 20% of the population is a group representation for descriptive survey research (Gay, 1992). Based on this strength, systematic sampling technique was used to select 12 schools from a list of 35 public secondary school obtained from Lari-Sub County Education Office which is about 34% of the total population. According to Orodho (2008) systematic sampling involves selecting members at equal intervals by picking some random points in the list and every $nth$ element is selected until the desired sample size is obtained. From the 12 sampled schools, all the 12 head teachers and all the 24 Mathematics teachers were purposively sampled.
to participate in the study. Orodho (2008) advises that a researcher should take all
the respondents if their number is less than 30.

The students were selected through systematic sampling by use of Mathematics
teacher's progressive record book to ensure equal and fair representation of all
students in the class. Form ones were left out, since they had not covered substantial
work in Mathematics course. Total number of students in the sample was three
hundred and sixty (360) which amounted to 15% of the population. Table 3.1 below
shows the sample size of different strata.

<table>
<thead>
<tr>
<th>Category</th>
<th>Sample size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head teachers</td>
<td>12</td>
</tr>
<tr>
<td>Teachers</td>
<td>24</td>
</tr>
<tr>
<td>Students</td>
<td>360</td>
</tr>
</tbody>
</table>

3.5 Research Instruments

The researcher employed questionnaires and an observation schedule for data
collection.

3.5.1 Questionnaires

Kombo and Tromp (2006) observed that questionnaires facilitate the researcher to
obtain information from a large sample in diverse regions and it upholds
confidentiality. The questionnaire instruments were preferred for this study because
they allowed greater uniformity of questions, hence ensuring greater comparability
of the information elicited by each set. Three sets of questionnaires were prepared to
help in data collection. These included:
a) One set of questionnaires was for head teachers which sought to establish the availability of ICT infrastructure like computer laboratories, computer hardware and software programs for integrating ICTs in Mathematics teaching in their schools; level of ICTs investment and the strategies in place to enhance ICTs integration in their schools.

b) The second set of questionnaires was for Mathematics teachers which sought to establish their level of preparedness as pertains to skills of integrating ICTs in Mathematics teaching, their attitudes towards the use of ICTs in Mathematics instruction, and the hindrances that they are encountering in the integration of ICTs in the teaching of Mathematics in their schools.

c) The last set of the questionnaires was for students which had two main sections; one to gauge their attitude and the other on their level of participation during mathematics.

3.5.2 Observation Guide
An observation schedule is used as a checklist to record what the researcher observes during data collection (Kombo and Tromp, 2006). The observation schedule in this study was used to verify the information collected on the availability of ICT infrastructure in each school, the total number of computers available for use by teachers and students, the schools connectivity to the Internet and how teachers are integrating ICTs in the teaching of Mathematics.

3.7 Piloting Study
Questionnaires were pre-tested using two schools in the neighboring Nyandarua Sub-County which had similar characteristics as the targeted schools before the actual data collection. The purpose of the pilot study was to verify the reliability and
validity of the research instruments and to enable the researcher modify and remove any ambiguous items on the instruments.

3.7.1 Validity

Validity is the extent to which an instrument achieves the purpose for which it was designed (Wiesma, 1985). Thus, content validity is a non-statistical method used to validate the content employed in the research instrument. Firstly, the researcher went through the instruments and compares their content with the set objectives to ensure that they contained all the information that addressed the study objectives.

Secondly, the researcher discussed with his supervisors and authorities in ICTs in education field about content validity of the instruments and thereafter recommendations and inputs were incorporated so as to improve on validity of the instruments.

3.7.2 Reliability

According to Mugenda and Mugenda (1999), the reliability of an instrument is the measure of the degree to which a research instrument yields consistent results or data after repeated trials. Test-retest method was used to check the reliability of the instruments. The instruments were piloted in two public secondary schools from Nyandarua Sub-County which were not included in the final sample. Here the questionnaires were given to the respondents to fill in. The filled in questionnaires were then be scored manually and after a period of two weeks the same instruments were administered to the same group and scored manually. A comparison of the first and second score was made using Pearson's product moment correlation coefficient to determine the reliability of the instruments.
Formula:
\[ Y = \frac{\sum xy - \sum x \sum y}{\sqrt{\left(\sum x^2 - \left(\sum x\right)^2 / N\right)\left(\sum y^2 - \left(\sum y\right)^2 / N\right)}}. \]

The correlation coefficient \( r \) of 0.8 obtained was considered reliable in the study. Orodho (2004) observes that about 0.8 correlation coefficient is high enough to judge the instruments as reliable for a study.

3.8 Data Collection Procedure

The researcher obtained a letter of introduction from the University and then visited the National Council of Sciences and Technology (NACOSTI) to seek a research permit. This permit was presented to Sub-County Education Officer Lari Sub-County who wrote a cover letter to all the sampled schools requesting them to allow the researcher to collect data and information from their schools. Appointments to the sampled schools were arranged prior to the visits to avoid any inconveniences to the respondents. The researcher then personally visited the sampled schools on the appointed days and dates to deliver and monitor the instruments to the principals, teachers and students. Confidentiality of the information provided was assured to all the respondents.

3.9 Data Analysis

The responses were coded and then entered into the Statistical Package for Social Sciences (SPSS) computer program for analysis after collecting the data. Data was analyzed quantitatively by using descriptive statistics such as frequencies and percentages. Conclusions and inferences were drawn after obtaining qualitative data from the open-ended questions and analyzed according to themes based on the study.
objectives and the research questions. The analyzed data was presented using Tables and figures. Finally, recommendations were made.

3.10 Logistical and Ethical Issues

The researcher had a fair use of data from other researchers, sources and acknowledged them on the references list with full confidentiality of data obtained from all questionnaires. The researcher sought permission from Sub-County Education Officer of Lari Sub-County. The consent of the respondents was sought before they are engaged in the process. The information collected was confidential and used for the purpose of the study only. Clarifications were given to the respondents where need arose.
CHAPTER FOUR
DATA PRESENTATION, ANALYSIS AND DISCUSSION

This chapter presents the findings of the study. The study sought to investigate the preparedness of public secondary schools in Kiambu County to integrate ICTs in the teaching of Mathematics.

The findings are discussed according to the following objectives:

i. To assess the availability of ICT infrastructure for integrating ICTs in Mathematics teaching in public secondary schools;

ii. To find out the attitude the teachers' hold towards the use of ICTs the teaching of Mathematics.

iii. To determine the students' attitudes towards the use of ICTs in the teaching of Mathematics; and

iv. To establish the challenges that the teachers are encountering in the integration of ICTs in the teaching of Mathematics in the schools.

4.1 Demographic Information of the Respondents

The study involved a survey of public secondary schools in Lari Sub-county of Kiambu County in Kenya. The school types included: two (16.7%) boys; two (16.7%) girls and eight (66.6%) mixed schools. The schools categories included: three county (25%) and nine (75%) district schools. The respondents included: 12 head teachers (9 males and 3 females) and 24 (40%) Mathematics teachers (14 males and 10 females). All the head teachers and teachers involved in the study were found to be professionally trained educators suited for secondary school teaching. Three hundred and sixty students (15%) were also conducted who were from two, three and four.
4.2 Infrastructure for Integrating ICTs in Mathematics Teaching

The first objective sought to assess the availability of infrastructure for integrating ICTs in Mathematics teaching like computer laboratories, computer hardware and software programs. Data obtained from the 12 sampled secondary schools revealed that ten (84%) of the schools had no computer laboratory one (8 %) had two computer laboratories each while one (8 %) had one computer laboratory as shown in Figure 4.1 below.

Figure 4.1: Number of Computer Laboratories in Secondary Schools

In the data collected, eleven of the head teachers (91.7 %) stated that the ratio of personal computers against the teachers and students population was inadequate in their schools.

This is a hindrance to effective integration of ICTs in Mathematics teaching because computers are the main platform where other integration tools like mathematical
software for teaching and Internet run. As it pertains to accessibility, students in only one school (8%) access computers throughout the day and in another one school (8%) students access computers only once either in the morning, midday or afternoon. The rest of the schools (84%) do not have computers hence students do not have access to computers at all. The study further revealed that only schools that had computer laboratories (16.7%) had employed ICT technicians while the rest of the schools (83.3%) had no ICT technicians.

The findings further revealed that application programmes and digital content for Mathematics teaching was poorly equipped with only one (8.3 %) of the county schools affirming that they had acquired software suited for Mathematics teaching while eleven of them (91.7%) did not have any of the afore said resources. None of the schools had the required software. Furthermore, only one school (8.3 %) allocated funds for integrating ICTs in Mathematics teaching. Eleven (91.7%) of the schools did not allocate funds for integrating ICTs in Mathematics teaching and learning because they said that the internet connectivity is not available and the schools cannot afford meeting its cost at the moment.

These findings are in agreement with Wabuye (2003) who indicated that while ICT has penetrated many sectors including banking, transportation, communications, and medical services, the Kenyan educational system seems to lag behind. The study found that computer use in Kenyan classrooms is still in its early phases, and concluded that the perceptions and experiences of teachers and administrators do play an important role in the use of computers in Kenyan classrooms. This investigations showed that very few high schools had sufficient ICT infrastructure for both teachers and students. Even in schools that have invested in the technology,
Farrel (2007) found out that the ratio of students to computers is as high as 50:1. He further noted that one of the barriers that have been observed to contribute to effective deployment of ICT in Kenya’s education system is inadequate infrastructure and network connectivity. Nonetheless, a small percentage of schools have direct access to high speed connectivity offered by local internet service providers.

In addition, Farrel (2007) who from a survey of ICT education in Kenya noted that very few secondary schools had sufficient ICT tools for teachers and students and even in schools that had computers, the student-computer ratio was very high to enhance any meaningful ICT integration in teaching. This poses a challenge to effective integration of ICTs in Mathematics teaching because computers are the main platform where other integration tools like mathematical software for teaching and internet run.

Kenya. School Net (2003) also found out that although schools were aware of benefits of ICTs in teaching, only a few had adequate ICT tools like computers and Internet that are essential for effective ICTs integration in teaching.

4.3 Teachers' Skills and Training for Integrating ICTs in Mathematics Teaching

The second objective sought to establish the teachers' readiness in terms of skills and training for integrating ICTs in the teaching of Mathematics. To address this objective, the study first established whether the teachers had acquired skills on using ICT (ie Computers and the internet. The second question established whether
The teachers have been inducted on integration of ICTS in Mathematics teaching. The third question established how the teachers acquired these integration skills. Twenty two teachers (92%) said that they had acquired some ICT skills as shown in Figure 4.2 below.

![Figure 4.2: Teachers with ICT skills](image)

From the above figure only 2 teachers (8%) said that they have not acquired any ICT skills from the formal training college, have not interacted with personal computers or attended any seminars organized by the schools. This results shows that although most teachers are computer literate, there are still those teachers who are computer illiterate.

Furthermore, twenty two (92%) of the sampled teachers reported that they have been inducted on integration of ICTs in Mathematics teaching mostly through SMASSE programme. Two (8.2%) of the sampled teachers reported that they had developed personal interaction with computers while two (8.2%) of the sampled teachers reported that they had formal training of computers in college. Twenty two
teachers (92 %) also said that they had acquired skills for preparing electronic content for Mathematics teaching.

SMASSE training programme is compulsory for every Mathematics and science teachers in Kiambu County which reveals that most of the sampled teachers had the requisite skills and training for integrating ICTs in Mathematics teaching. This findings shows how successful SMASSE programme has been in ensuring that teachers are equipped with ICT in teaching integration skills.

Different studies done by other researchers in other places have shown that such programmes have not adequately modeled the use of technology in their method courses(Adamy and Boulmetis, 2006) or incorporated effective approaches to technology integration into a single technology courses (Brown and Warschauer, 2006). A US study by Manoucherhi(1999) concluded that lack of computer use is due to lack of experience and access to educational software; lack of adequate professional training and lack of professional support in the use of computers in Mathematics instruction. In New Zealand and Australia, similar studies by D'Sousa, Sabita and Woods (2003) and Palmer (2002) identified that the common barrier to technology use in the classroom was a lack of professional development and lack of access to computers. Swan and Dixon(2006) suggested the need to put in place training programs for technology while Toumasis (2006) suggested the need to teach teachers the application of software packages. However, Sorkin et al (2004) advocated for the establishment of instructional strategies and lesson planning with full integration of technology in the teaching of mathematics; ideas which were also shared by Hardy (2004). The need for a proper professional development was emphasized by Wells and Sprague (2007) while Sorkin et al further stressed the need
to carry out effective training in software use including the need to consider teachers’ preferences regarding the liberty to choose their instructors.

4.4 Teachers' and Students' Attitudes towards the Use of ICTs in Mathematics Instruction

The third objective sought to determine the teachers' and students' attitudes towards the use of ICTs in Mathematics instruction. The teachers were asked to rate the extent to which ICT skills enhances their use of electronic technologies in their teachings of Mathematics. These teachers said that they usually integrated the technologies in their lessons to the extents shown in figure 4.3 below.

\[\text{Figure 4.3: Integration of ICT in Teaching}\]

From the figure above 21 teachers (87%) responded in the affirmative. They had embraced the use of ICT technology in their teaching. Also, the research found out that 3 teachers (13%) had not yet integrated ICT technology in their teaching. The reasons they gave were that ICT infrastructure and resources were limited or not available at all.
The teachers were further asked to rate the extent to which ICT skills enhances their use of electronic technologies in their teachings of Mathematics. They were required to state their extent levels on a Likert scale ranging from great extent to very little extent as shown in Table 4.1 below.

Table 4.1: Extent to which ICT skills enhances use of electronic technologies in Mathematics Teaching

<table>
<thead>
<tr>
<th>Extent</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Great extent</td>
<td>16</td>
<td>66.7</td>
</tr>
<tr>
<td>Undecided</td>
<td>2</td>
<td>8.3</td>
</tr>
<tr>
<td>Little extent</td>
<td>4</td>
<td>16.7</td>
</tr>
<tr>
<td>Very little extent</td>
<td>4</td>
<td>8.3</td>
</tr>
</tbody>
</table>

Table 4.1 above indicates the mean obtained from SPSS to be 3.333. This mean is higher than the average mean in Likert scale which shows that ICT skills enhanced the use of electronic technologies to a great extent. Sixteen teachers (66.7 %) responded that ICT skills enhanced their use of electronic technologies in their teaching of Mathematics to a very great extent. This means that teachers regularly use ICT technology in teaching Mathematics because they have ICT skills. On the other hand, 2 teachers (8.3%) said that ICT skills enhanced their use of electronic technologies in their teaching of Mathematics to a little extent. This means that teachers rarely use ICT technology in their teaching of Mathematics. A further 2 teachers (8.3%) responded that ICT skills enhanced their use of electronic teaching to a very little extent. These results showed that teachers very rarely use ICT technology. It could be because they have never interacted with computers at all. The findings further found out that 2 teachers (8.3%) were undecided. This means
that the teachers could not be able to rate the extent which the ICT skills they have acquired enhanced the use of electronic technologies in their teaching of Mathematics.

The teachers were also told to rate the extent to which they integrated ICT in their teaching of Mathematics and they gave the following responses in a five Likert scale ranging from very great extent to very little extent according to Table 4.2.

### Table 4.2: Extent of ICT integration in Teaching of Mathematics

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very great extent</td>
<td>2</td>
<td>8.3</td>
<td>2.375</td>
</tr>
<tr>
<td>Very great extent</td>
<td>2</td>
<td>8.3</td>
<td></td>
</tr>
<tr>
<td>Undecided</td>
<td>3</td>
<td>12.5</td>
<td></td>
</tr>
<tr>
<td>Little extent</td>
<td>13</td>
<td>54.2</td>
<td></td>
</tr>
<tr>
<td>Very little extent</td>
<td>4</td>
<td>16.7</td>
<td></td>
</tr>
</tbody>
</table>

Table 4.3 above indicates the mean obtained from SPSS to be 2.375 in which those who had integrated ICT in their teaching to a very great extent were 2 teachers (8.3%) those who had integrated ICT in their teaching to a great extent were 2 teachers (8.3%). The mean is lower than the average mean in the 5-point Likert scale which implies that only a few teachers had integrated ICT in their teaching to a very great extent and great extent respectively. This means that these teachers had acquired ICT skills which enhance the use of ICT technology. In addition, ICT infrastructure and resources could be available in their schools. The findings further indicated that 13 teachers (54.2%) had integrated ICT in their teaching to a little extent while 4 teachers (16.7%) responded that they had integrated it to a very little extent.
extend. It was also established from the findings that 3 teachers (12.5%) were not able to rate the extend of their integration of ICT in the teaching of Mathematics.

When teachers were asked to indicate the frequency to which they integrated ICT technologies in their teaching and gave the following responses as shown in table 4.3.

Table 4.3: Frequency of ICT integration in Mathematics Teaching

<table>
<thead>
<tr>
<th></th>
<th>Always</th>
<th>Sometimes</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer</td>
<td>2</td>
<td>21</td>
<td>1</td>
</tr>
<tr>
<td>CD ROMS</td>
<td>1</td>
<td>1</td>
<td>22</td>
</tr>
<tr>
<td>Internet</td>
<td>2</td>
<td>20</td>
<td>2</td>
</tr>
<tr>
<td>E-Mail</td>
<td>0</td>
<td>0</td>
<td>24</td>
</tr>
</tbody>
</table>

From the table above, it is clear that 2 teachers (8.3%) used computers always, 21 teachers (87.5%) used computers sometimes and 1 teacher (4.2%) never used a computer. On the use of internet, 2 teachers (8.35%) used it always, 20 teachers (83.3%) used it sometimes and a further 2 teachers (8.35%) never used the internet. The findings found out that 1 teacher (4.2%) used CD ROMS always, 1 teacher used it sometimes and 22 teachers never used CD ROMS at all. The e-mail was never used by all teachers to facilitate teaching according to the research.

When asked to state how integration of ICTs benefited teaching of Mathematics, the teachers gave the benefits as shown in table 4.4.
Table 4.4: Benefits of ICT use in teaching Mathematics

<table>
<thead>
<tr>
<th>Benefits</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Availability of teaching Materials</td>
<td>4</td>
<td>16.7</td>
</tr>
<tr>
<td>Makes Teaching and learning interesting</td>
<td>10</td>
<td>41.7</td>
</tr>
<tr>
<td>Brings abstracts concepts to live</td>
<td>1</td>
<td>4.1</td>
</tr>
<tr>
<td>Improves performance in Mathematics</td>
<td>6</td>
<td>25</td>
</tr>
<tr>
<td>Enhances development of Teaching and learning Materials</td>
<td>1</td>
<td>4.1</td>
</tr>
<tr>
<td>N/A</td>
<td>2</td>
<td>8.4</td>
</tr>
</tbody>
</table>

Table 4.4 above shows that 22 of the teachers (91.7 %) gave some benefits that they derive from integrating ICTs in their Mathematics teaching. This shows that most of the teachers had positive attitude towards ICT integration in Mathematics instruction. Also, 10 teachers (41.7%) stated that ICT use makes teaching and learning interesting while 1 teacher (4.1%) responded that ICT use brings abstract concepts to live. Furthermore, 6 teachers (25%) stated that ICT use improves performance in Mathematics while 1 teacher (4.1%) pointed that ICT enhances development of teaching and learning materials while 2 teachers (8.4%) stated that there are no benefits of ICT use.

The findings above are in agreement with research done by Ittigson and zewe (2003) who concluded that ICT helps in not only improving the method of teaching mathematics but also enhance understanding of the basic concepts of the content amongst the students. Becta (2003) also pointed out a number of key benefits of integrating ICTs in the teaching of mathematics. One benefit being the ability of the ICT to promote greater communication, knowledge-sharing and collaboration among students. The technology has also been found to facilitate teachers ability to
provide fast and accurate feedbacks to learners which eventually leads to higher levels of motivation among the learners. Besides supporting constructivist pedagogy, the other benefit is that it allows the student to concentrate on strategies of solving questions and interpretations of answers provided thus saves them time spend on tedious computational calculations. Technology helps students to explore and a better understanding of the concepts relevant to mathematics. Basically, this approach is ideal for promotion of higher order thinking as well as better strategies to problem solving; the key elements in the learning of mathematics.

The students except form ones were conducted to gauge their attitudes as shown in the figure 4.4 below.

![Representation Per Class](image)

**Figure 4.4: Representation Per Class**

From the figure above 12 form two students (33%) were conducted to gauge their attitude they have developed towards mathematics. In addition, 12 form three students (33%) and 12 form four students (33%) were also conducted respectively. The form one's were left because they have not covered much content hence cannot be able to give relevant information needed.
When the students were also conducted to determine whether they have removed the negative attitude towards the subject, they gave the results as shown in figure 4.5.

**IS MATHEMATICS DIFFICULT?**

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Undecided</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>39%</td>
<td>3%</td>
<td>11%</td>
<td>42%</td>
<td>5%</td>
</tr>
</tbody>
</table>

**Figure 4.5: Mathematics is not difficult**

The figure above shows that two hundred and ninety students (81%) strongly agree and agree that mathematics is not a difficult subject. This showed that the students had developed positive attitude towards the learning of Mathematics. When asked whether the students used ICT (computer) in solving Mathematics they gave the following response as shown in the figure 4.6.
The findings in figure 4.6 above showed that two hundred and forty (67%) of the students have not embraced the use of ICT technology because of the lack of ICT infrastructure in the schools.

According to Davis et al. (1989), a positive attitude arises due to previous successful experiences or from a perception that success is possible. In their Technology Acceptance Model (TAM), Davis et al. Suggests that attitudes towards computer adoption directly influence intentions to use the computer and ultimately actual computer use. These authors also demonstrated that an individual's initial attitudes regarding a computer's ease of use and a computer's usefulness influence attitudes toward use and that training significantly improved the computer self-efficacy of both males and females. The training of Mathematics teachers in Lari Sub County mostly through the SMASSE programme can thus be said to have shaped their positive attitudes towards ICTs integration in Mathematics teaching.
4.5 Challenges of Teachers' Integration of ICTs in Mathematics Teaching

The fourth objective sought to establish the challenges that teachers are encountering in their effort to integrate ICTs in the teaching of Mathematics in their schools. Table 4.5 below shows the main challenges noted by teachers.

Table 4.5: Challenges of ICTs Integration in Mathematics Teaching

<table>
<thead>
<tr>
<th>Challenges</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of enough time to prepare</td>
<td>4</td>
<td>16.7</td>
</tr>
<tr>
<td>Lack of ICT infrastructure and equipment</td>
<td>12</td>
<td>50</td>
</tr>
<tr>
<td>Lack of teachers and students ICT skills</td>
<td>2</td>
<td>8.3</td>
</tr>
<tr>
<td>Lack of support by management</td>
<td>6</td>
<td>25</td>
</tr>
</tbody>
</table>

In the Table 4.5 above, it is clear that half of the teachers (50%) stated that unavailability of ICT infrastructure and equipment and 25% of the teachers identified lack of support by management are the main challenges to ICT integration in Mathematics instruction. This findings are supported by twenty two teachers (91.7%) and ten head teachers (83.3%) who noted that ICTs in their schools were not enough and that their schools doesn't allocate financial resources for ICT integration in their schools. The research further found out that 4 teachers (16.7%) identified that the main challenge is lack of enough time to prepare. Lastly, 2 teachers (8.3%) stated that lack of ICT skills by both teacher and students is the main challenge to ICT integration in Mathematics instruction.

The above findings are in agreement with a research done by Jones (2004) who identified that some of the barriers to integration of ICT in classroom include low level of confidence among teachers; poor accessibility to resources; inadequate time
for the integration; poor training; technical problems encountered during the use of software; absence of personal accessibility during time of lesson preparation; and the advancing age of the teachers. Other challenges identified by Snoeyink and Ertmer (2002) include absence or inadequate computers in schools, poor quality software, limited time, technical problems in use of equipment, attitudes of teachers towards computers, inadequate funding, low level of confidence among teachers, stiff resistance to change by those used to traditional approach, lack of administrative support, absence of computer skills, inconsistent match with the curriculum, difficulties of scheduling, inadequate or lack of training opportunities on relevant skills, and lack of clear vision and know-how on integration of ICT as part of the instruction.

When teachers were asked to suggest the steps that can be taken to hasten the integration of ICTs in Mathematics teaching they responded as shown in Table 4.6.

<table>
<thead>
<tr>
<th>Steps</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>MoE to provide standard Mathematical software for learning</td>
<td>3</td>
<td>12.5</td>
</tr>
<tr>
<td>ICT infrastructure to be provided to schools</td>
<td>16</td>
<td>66.7</td>
</tr>
<tr>
<td>Computer studies to be made compulsory in schools</td>
<td>2</td>
<td>8.3</td>
</tr>
<tr>
<td>Mathematics and science teachers to be trained in ICT</td>
<td>3</td>
<td>12.5</td>
</tr>
</tbody>
</table>

integration in teaching
Table 4.6 above shows that 16 teachers (66.7%) suggested that schools should be provided with adequate ICT infrastructure and equipment for effective ICTs integration in Mathematics teaching. Generally, these findings agree with those of Jain (2006) who mentioned inadequate IT exposure in schools; poor communication infrastructure and expensive ICT equipment as being some of the major impediments to ICT use in education in Africa. This touches the need to provide enough ICTs and the proper ICT infrastructure for teachers' and students' use so as to enhance ICT integration in Mathematics teaching in public secondary schools.
CHAPTER FIVE
SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This chapter presents a summary of the findings gathered from the analysis of the data. Conclusions have been drawn from the study and recommendations put forward that may help to understand the level of preparedness of public secondary schools in Lari sub County of Kiambu County to integrate ICTs in the teaching of mathematics. Also, suggested topics for further research have been put forward. The study objectives were:

i. To assess the availability of ICT infrastructure (like computer laboratories, computer hardware and software programs) for integrating ICTs in Mathematics teaching in the schools;

ii. To establish the teachers' readiness in terms of skills and training for integrating ICTs in the teaching of Mathematics;

iii. To determine the teachers' and students' attitudes towards the use of ICTs in Mathematics instruction; and

iv. To establish the challenges that teachers are encountering in the integration of ICTs in the teaching of Mathematics in the schools.

5.1 Summary of the Research Findings

The following is a summary of the results which were achieved after analyzing the results in chapter four:

i. Ten (84 %) of the schools in Lari sub county had no computer laboratory one (8 %) had two computer laboratories each while one (8 %) had one computer laboratory. Also, eleven of the head teachers (91.7 %) stated that the ratio of personal computers against the teachers and students population was inadequate
in their schools that could ensure effective integration of ICTs in Mathematics teaching. The findings further revealed that application programmes and digital content for Mathematics teaching was poorly equipped with only one (8.3%) of the county schools affirming that they had acquired software suited for Mathematics teaching while eleven of them (91.7%) did not have any of the afore said resources.

ii. Half of the teachers (50%) have been inducted on integration of ICTs in Mathematics teaching mostly through the SMASSE programme while 18 of them (75%) have skills for preparing electronic content for Mathematics teaching.

iii. Sixteen teachers (66.7%) ICT skills enhanced their use of electronic technologies in their teaching of Mathematics. When asked whether they integrated ICT technologies in their teaching, 21 teachers (87.5%) responded in the affirmative. Thirteen of the teachers (54.2%) integrated ICT in their teaching of Mathematics to a little extent while four teachers (16.6%) integrated their teaching to a very great extent and great extent respectively. Twenty of the teachers (92.1%) gave some benefits that they derive from integrating ICTs in their Mathematics teaching. This shows that most of the teachers had positive attitude towards ICT integration in Mathematics instruction. Two hundred and ninety students (80.5%) strongly agree and agree that mathematics is not a difficult subject. This showed that the students had developed positive attitude towards the learning of Mathematics. Two hundred and forty (66.7%) of the students have not embraced the use of ICT technology because of the lack of ICT infrastructure in the schools.
iv. Half of the teachers (50%) stated that unavailability of ICT infrastructure and equipment and 25% of the teachers identified lack of support by management are the main challenges to ICT integration in Mathematics instruction. This findings are supported by twenty two teachers (91.7%) and ten head teachers (83.3%) who noted that ICTs in their schools were not enough and that their schools doesn’t allocate financial resources for ICT integration in their schools.

5.2 Conclusion of the Study

Conclusions of the study findings were made based on the relationships that were established for each of the different objectives. From the foregoing summary of findings, it can be concluded that:

i. Public secondary schools in Lari sub county kiambu County were inadequately equipped with facilities like computer laboratories and equipment like computers and computer laboratories required for the successful integration of ICTs in Mathematics teaching implementation. Moreover, most of the schools lacked software, application programmes and digital content necessary for integration of ICTs in Mathematics;

ii. Most of the Mathematics teachers had learnt how to integrate ICT in the teaching and learning of Mathematics. They had also had acquired skills for preparing electronic content for Mathematics teaching.

iii. Most teachers in the district had a positive attitude towards the use of ICTs in Mathematics instruction. Most of them indicated that ICT enhances the can availability of instructional materials; make the teaching and learning of Mathematics interesting which are factors that are viewed as key for promoting performance of Mathematics.
iv. Poor ICT infrastructure and management commitment were the key challenges to effective ICTs integration in Mathematics teaching in Lari Sub County.

5.3 **Recommendations**

Based on the findings from this study, the researcher makes the following recommendations:

i. Education stakeholders in the country should finance provision of ICT facilities and equipment in public secondary schools. This includes provision of computers, power generators, computer laboratories in all secondary schools which enhance the use of computers in teaching and learning of Mathematics.

ii. All Mathematics teachers should be constantly trained to ensure that they get updated with ICT skills.

iii. The government through MoE, the PTA and other educational stakeholders who finance free secondary education should allocate more tuition fees and encourage schools to have a specific vote head for computers so as to ensure reliable funding of computers by schools. Moreover, MoE should ensure efficient and effective use of funds to create sustainable computer programmes in their schools.

5.4 **Recommendations for Further Research**

i. A comparative study involving private learning institutions can be carried out to establish the extent of ICT uptake in Mathematics instruction.

ii. A study to establish the impact of ICTs integration in Mathematics teaching in public secondary schools should be undertaken.

iii. A similar study can be carried out to compare the level of preparedness in National, County and district public secondary schools.
REFERENCES


The annotated bibliography is provided in the following format:


APPENDICES

APPENDIX I: QUESTIONNAIRE FOR HEADTEACHERS

This study seeks to establish the readiness of public secondary schools to integrate ICTs in Mathematics teaching. Your school is among the few that have been selected for the study and your honest response to this questionnaire will make it a success.

SECTION A: BACKGROUND INFORMATION

1. (i) What is your gender? Male [ ] Female [ ]

(ii) What is your professional qualification?

M.Ed [ ] B.Ed [ ] PGDE [ ]

Diploma in education [ ]

(iii) Have you ever attended any course on integration of ICTs in schools?

Yes [ ] No [ ]

If yes above, indicate who organized the course and explain how the course has helped you to integrate ICTs in your school.

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

SECTION B: ICT FACILITIES AND PERSONNEL

2. (i) How many computer laboratories are there in your school?.........................

(ii) What is the total number of computers in your school?..........................

(iii) How adequate are the available computers against teacher and student population?

Adequate [ ] Not adequate [ ]
(iv) What is the student per computer ratio?

(v) What times of the day are computers accessible?
   (a) Students: Morning [ ] Mid-day [ ] Afternoon [ ]
   (b) Teachers: Morning [ ] Mid-day [ ] Afternoon [ ]
   (c) Not accessible [ ]

(vi) Has the school employed a computer laboratory technician(s)?
   Yes [ ] No [ ]
   If yes, what is the qualification of the technician(s)?

(vii) What are the hindrances to acquiring ICT infrastructure in the school?

(viii) (a) Does the school allocate financial resources for ICT integration?
   Yes [ ] No [ ]
   (b) If yes above, state the adequacy of the financial resources allocated.
      Adequate [ ] Inadequate [ ]

(x) How is the school equipped with computer accessories?
   Well equipped [ ] Moderate [ ]
   Poorly equipped [ ]
SECTION C: INTEGRATION OF ICT IN TEACHING

3. i) What is your school's policy as regards to ICT integration in teaching and learning?

ii) Are the software modules, application programmes and digital content to teach Mathematics available in your school?
   Yes [ ] No [ ]

(iii) Which of the following ICT applications does the school use? *(Tick on the ones that are used in your school)*

- Web-based (online) learning [ ]
- Computer-based learning [ ]
- Virtual classrooms [ ]
- Digital collaborations [ ]
- None [ ]
- Others (specify) ..........................................................

(iv) Are there courses organized by your school for teachers who have no knowledge on use of electronic technologies (i.e computers and Internet) in teaching and learning process?
   Yes [ ] No [ ]

(v) If yes in (iii): above, please state the type of courses? ..........................................................

.................................................................................................................................
(vi) If no in (iii) above, please explain your response?

(vii) How are teachers periodically updated on the new developments on ICT use in education?

4. (i) (a) Is your school connected to the Internet?
Yes [ ] No [ ]

(b) If yes, to what extent do teachers and students use Internet for teaching and learning?

(ii) (a) Is the cost of the Internet affordable to the school?
Yes [ ] No [ ]

(b) Explain your response in (ii) above.

(iii) Do the students and teachers have access to Internet connected computers?
Yes [ ] No [ ]

SECTION D: FINANCING OF ICT ACTIVITIES IN THE SCHOOL

6. (i) Indicate the percentage of financial support from the following to ICT and services in the school.

Government ..............................................................................

Donors ..................................................................................

Parents .................................................................................

Others (specify) ...................................................................
(ii) (a) In your opinion, is financing of ICT integrations in your school adequate?

Yes [ ] No [ ]

(b) Rate the extent of adequacy of ICT integration financing in your school.

Very adequate [ ] Adequate [ ]
Average [ ] Inadequate [ ]
Very inadequate [ ]

(iii) How can the financing of ICT integration be improved? ...........................................
.................................................................................................................................

5. Suggest measures that can hasten the implementation of ICT integration in public secondary schools in Kenya ................................................................................................................
......................................................................................................................................
......................................................................................................................................

Thank you for responding to this questionnaire
APPENDIX II: QUESTIONNAIRE FOR TEACHERS

This study seeks to establish the preparedness of public secondary schools to integrate ICTs in Mathematics teaching. Your school is among the few that have been selected for the study and your honest response to this questionnaire will make it a success. Please tick ( ) where appropriate or fill in the required information in the spaces provided.

SECTION A: PERSONAL INFORMATION

Background information

1. Your sex: Female [ ] Male [ ]

2. Level of education:
   M.Ed degree [ ] Bachelor’s degree [ ]
   Diploma [ ]

3. (i) Have you acquired skills on using ICT electronic technologies (i.e. computers and the Internet)?
   Yes [ ] No [ ]

(ii) If yes, how did you acquire the skills?
   Formal training in college [ ]
   Personal interaction with computers [ ]
   Seminars organized by school [ ]
   Others (specify) ........................................................................................................
   .........................................................................................................................
(iii) Rate the extent to which your ICT skills enhance your use of electronic technologies in your teaching of mathematics.

Great extent [ ]
Undecided [ ]
Little extent [ ]

SECTION B: INTEGRATION OF ICT IN TEACHING

4. (i) (a) In your teaching of, do you integrate ICT technologies (i.e Computer and Internet)?

Yes [ ]
No [ ]

(b) If yes, to what extent?

Very great extent [ ]
Great extent [ ]
Undecided [ ]
Little extent [ ]
Very little extent [ ]

(c) Please explain your response to (b) above .................................................................

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

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

(ii) Besides each of the aspects or components presented below, please indicate the frequency by which you integrate them in your teaching.

<table>
<thead>
<tr>
<th>Component/Aspect</th>
<th>Always</th>
<th>Sometimes</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CD roms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internet</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Email</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
(iii) In which ways do you benefit from the integration of electronic technologies in your Teaching?

(iv) Do you use the Internet as an aid in the teaching and learning process?
   Yes [ ] No [ ]

(v) If yes to (iv) above, where do you normally access the Internet?
   From my school [ ] From my server [ ]
   From cyber café [ ]

(vi) Do your students submit their assignments through e-mail?
   Yes [ ] No [ ]

(vii) If yes, comment on the effectiveness of the arrangement?

SECTION C: SKILLS TO INTEGRATE ICT IN MATHEMATICS TEACHING

5. (i) Have you acquired any training in integration of ICTs in Mathematics teaching?
   Yes [ ] No [ ]

(ii) If yes to (i) above, briefly state how the skills have enhanced your teaching

(iii) Do you have skills in the preparation of electronic content for use during your teaching?
   Yes [ ] No [ ]
(iv) If yes to (iii) above, do you always prepare electronic content for your students?
Yes [ ] No [ ]

(v) Which challenges do you encounter in preparing electronic content for your teaching?

SECTION D: ATTITUDES TOWARDS USE OF ICTs IN MATHEMATICS TEACHING

Please indicate whether you strongly agree (SA), agree (A), are undecided (U), disagree (D), or strongly disagree (SD) with the following statements relating to your views about the role of ICTs in Mathematics teaching

<table>
<thead>
<tr>
<th>Statement</th>
<th>SA</th>
<th>A</th>
<th>U</th>
<th>D</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICTs enhance availability of Mathematics instructional materials</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ICTs enhance development of teaching and learning materials</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ICTs enhance dissemination of information and knowledge during teaching of Mathematics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ICTs support student centered methods of teaching Mathematics.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ICTs bring abstract concepts to live during Mathematics lessons</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ICTs make the teaching and learning of Mathematics interesting</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ICTs improves performance in mathematics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
SECTION E: HINDRANCES TO INTEGRATION OF ICT IN MATHS TEACHING

6. What are the hindrances to integrating electronic technologies in mathematics teaching in your school?


7. Kindly comment on the accessibility to ICT facilities in your school by:
   i) The teacher


   ii) The teacher


8. In your view, which steps can be taken to hasten the integration of ICTs in Mathematics teaching in public secondary schools in Kenya?


Thank you for responding to this questionnaire
APPENDIX III: STUDENTS’ QUESTIONNAIRE

SCHOOL .........................................................................................................................
CLASS ..............................................................................................................................

SEX MALE [ ] FEMALE [ ]

SECTION I

Read the following statements and kindly give your honest opinion by placing a tick in the appropriate box.

<table>
<thead>
<tr>
<th>No.</th>
<th>Statement</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>undecided</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Mathematics is not difficult</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>I enjoy learning Mathematics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Mathematics is a necessary and an important subject</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>I know I can do well in Mathematics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Both girls and boys can do well in Mathematics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>My teacher is interested in me passing Mathematics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>I often find myself solving Mathematics during my free time</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>I sometimes skip Mathematics lessons</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>I am satisfied with the way the teacher teaches Mathematics using ICT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SECTION II
The following statements refer to your participation in a Mathematics lesson. Read each statement carefully and evaluate your level of participation by placing a tick in the relevant position.

**Key**

- No participation [0]
- Minimum participation [1]
- Average participation [2]
- Above average participation [3]

<table>
<thead>
<tr>
<th>NO</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>Asking question/ Answering question</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Seeking clarification on areas not understood</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Volunteer to perform a task during a lesson</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Using ICT (computer) in solving mathematics problem</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX IV: OBSERVATION SCHEDULE

1. Name of the school .................................................................

2. Number of computer laboratories available .....................................

3. Number of computers available for use by
   i. Teachers ..............................................................................
   ii. Students ..........................................................................  

4. Internet connectivity of the school ....................................................

5. Accessibility to ICT facilities by:
   i. Teachers ..............................................................................
   ii. Students ..........................................................................

6. Number of computer technicians available ......................................

7. Integration of ICTs in Mathematics teaching in the school .............
APPENDIX V: LETTER OF INTRODUCTION TO THE
HEADTEACHER

Kenyatta University,
Department of Educational Management,
Policy and Curriculum Studies.
P. O. Box 43844,
NAIROBI.

The Principal

---------------------------------

LARI SUB-COUNTY.

Dear Principal,

RE: RESEARCH INFORMATION

I am a student at Kenyatta University pursuing a Masters Degree in Education. I am conducting a research on the preparedness of ICT integration programme on the teaching and learning of Mathematics in Public Secondary Schools in Lari Sub-County. I would be very grateful if you, your Mathematics teacher(s) and students would respond to my questionnaires.

I would like to assure you that the information gathered will be for the purpose of this research only and will be treated with strict confidential.

Thank you.

Yours Faithfully,

Kiprotich Gideon.
## APPENDIX VI: RESEARCH TIME FRAME

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>DURATION</th>
<th>FROM-TO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proposal writing</td>
<td>3 months</td>
<td>Oct 2014-Jan 2015</td>
</tr>
<tr>
<td>Proposal approval</td>
<td>1 month</td>
<td>Feb 2015</td>
</tr>
<tr>
<td>Correcting the proposal</td>
<td>1 month</td>
<td>March 2015</td>
</tr>
<tr>
<td>Defending the proposal</td>
<td></td>
<td>April 2015</td>
</tr>
<tr>
<td>Piloting</td>
<td>2 weeks</td>
<td>May 2015</td>
</tr>
<tr>
<td>Data collection</td>
<td>2 months</td>
<td>May- July 2015</td>
</tr>
<tr>
<td>Data analysis, writing and revision of project</td>
<td>3 months</td>
<td>August-Sep 2015</td>
</tr>
<tr>
<td>Project examination</td>
<td></td>
<td>October 2015</td>
</tr>
<tr>
<td>Graduation</td>
<td></td>
<td>December 2015</td>
</tr>
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</table>
APPENDIX VII: RESEARCH BUDGET

<table>
<thead>
<tr>
<th>ITEM</th>
<th>AMOUNT (KSH)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proposal typing and printing</td>
<td>4000</td>
</tr>
<tr>
<td>Piloting</td>
<td></td>
</tr>
<tr>
<td>i. Photocopying</td>
<td>2000</td>
</tr>
<tr>
<td>ii. Travelling</td>
<td>1000</td>
</tr>
<tr>
<td>Data collection</td>
<td></td>
</tr>
<tr>
<td>i. Photocopying of research instruments</td>
<td>4000</td>
</tr>
<tr>
<td>ii. Travelling</td>
<td>6000</td>
</tr>
<tr>
<td>iii. Subsistence</td>
<td>3000</td>
</tr>
<tr>
<td>iv. Two research assistants</td>
<td>5000</td>
</tr>
<tr>
<td>Data analysis</td>
<td></td>
</tr>
<tr>
<td>i. Typing and printing</td>
<td>5000</td>
</tr>
<tr>
<td>ii. Photocopying</td>
<td>5000</td>
</tr>
<tr>
<td>iii. iii) Binding</td>
<td>3000</td>
</tr>
<tr>
<td>Total</td>
<td>38000</td>
</tr>
</tbody>
</table>
APPENDIX IX: LIST OF PUBLIC SECONDARY SCHOOLS IN LARI SUB-COUNTY AND THE ENROLMENT 2014

<table>
<thead>
<tr>
<th>NO</th>
<th>NAME OF SCHOOL</th>
<th>NO</th>
<th>NAME OF SCHOOL</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.</td>
<td>Escarpment Sec0ndary</td>
<td>22.</td>
<td>Gitithia Girls</td>
</tr>
<tr>
<td>11.</td>
<td>Kijabe Boys</td>
<td>29.</td>
<td>Kinale High</td>
</tr>
<tr>
<td>16.</td>
<td>Lari Secondary</td>
<td>34.</td>
<td>D.N Kiburi Sulmac</td>
</tr>
<tr>
<td>17.</td>
<td>Gatamaiyu secondary</td>
<td>35.</td>
<td>Kariguini Secondary</td>
</tr>
</tbody>
</table>
APPENDIX X: RESEARCH PERMIT FROM NACOSTI

NATIONAL COMMISSION FOR SCIENCE,
TECHNOLOGY AND INNOVATION

Telephone: +254-20-2213471,
2241349, 310571, 2219420
Fax: +254-20-318245, 318249
Email: secretary@nacosti.go.ke
Website: www.nacosti.go.ke
When replying please quote

Ref: No.

NACOSTI/P/15/85707/8047
Kiprotich Gideon
Kenyatta University
P.O. Box 43844-00100
NAIROBI.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on
"Preparedness of Information Communication and Technology Integration
in Mathematics Teaching: A Case of Public Secondary Schools in Kiambu
County, Kenya," I am pleased to inform you that you have been authorized to
undertake research in Kiambu County for a period ending 14th October,
2016.

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

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

Said Hussein
FOR: DIRECTOR GENERAL/CEO

Copy to:
The County Commissioner
Kiambu County.
The County Director of Education
Kiambu County.
APPENDIX XI: RESEARCH PERMIT FROM LARI DISTRICT

EDUCATION OFFICE

KENYATTA UNIVERSITY
GRADUATE SCHOOL

E-mail: dean-graduate@ku.ac.ke
Website: www.ku.ac.ke

Our Ref: E55/CE/24290/2013

DATE: 8th September, 2015

Director General,
National Commission for Science, Technology
And Innovation
P.O Box 306-00100
NAIROBI

Dear Sir/Madam,

RE: RESEARCH AUTHORIZATION FOR KIPROTICH GIDEON– REG. NO.
E55/CE/24290/2013

I write to introduce Mr. Kiprotich Gideon who is a Postgraduate Student of this University. He is registered for M.ED degree programme in the Department of Education Management, Policy and Curriculum Studies.

Mr. Kiprotich intends to conduct research for an M.ED. Proposal entitled, "Preparedness of Information Communication and Technology Integration in Mathematics Teaching: A Case of Public Secondary Schools in Kiambu County, Kenya”.

Any assistance given will be highly appreciated.

Yours faithfully,

MRS. LUCY N. MRAABU
FOR: DEAN, GRADUATE SCHOOL
APPENDIX XII: RESEARCH PERMIT

THIS IS TO CERTIFY THAT:
MR. KIPROTICH GIDEON
of KENYATTA UNIVERSITY, 43844-100
nairobi, has been permitted to conduct
research in Kiambu County

on the topic: PREPAREDNESS OF
INFORMATION COMMUNICATION AND
TECHNOLOGY INTEGRATION IN
MATHEMATICS TEACHING; A CASE OF
PUBLIC SECONDARY SCHOOLS IN
KIAMBU COUNTY, KENYA

for the period ending:
14th October, 2016

Applicant's Signature

Permit No: NACOSTI/P/15/85707/8047
Date of Issue: 14th October, 2015
Fee Received: Ksh 1000

Director General
National Commission for Science,
Technology & Innovation

KENYATTA UNIVERSITY LIBRARY