INFLUENCE OF TEACHERS' CHARACTERISTICS ON THEIR ATTITUDE AND PREPAREDNESS TO INTEGRATE INFORMATION COMMUNICATION TECHNOLOGY IN PRIMARY SCHOOLS MATHEMATICS INSTRUCTION IN NAKURU EAST SUB-COUNTY - KENYA

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A Thesis Submitted to the Graduate School in Partial Fulfillment of the Requirements for the Master of Education Degree in Curriculum and Instruction of Egerton University

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NOVEMBER, 2021

DECLARATION AND RECOMMENDATION

Declaration

I hereby do declare that the thesis is my original work and has not been submitted to any other institution of higher education for the award of a diploma or conferment of a degree.

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Recommendation

This thesis has been submitted with our approval as the university supervisors.

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DEDICATION

I dedicate this work to my loving husband and my children.

ACKNOWLEDGMENTS

Let me admit that this work has not been easy. It wouldn't have been possible without the enormous knowledge, abundance of ideas, time and encouragement through strict timelines of my supervisors Prof. B.N. Githua and Dr. J.K. Ngeno, who have made it possible to get to this far. I also acknowledge the part played by my course mates and colleagues at workplace who have freely and willingly shared their ideas, progress and successes in their projects, in the process encouraging me to move on. May Almighty God bless them abundantly.

ABSTRACT

There is pressure placed on the Government of Kenya and the private sectors in the country to strive and compete in the digital world in their operations. In particular, the use of Information Communication Technology (ICT) in institutional operations in Kenya is a significant challenge, especially in the education sector. Lack of ICT skills by teachers is the main difficulty in integration of ICT in instructional processes in schools. This study sought to find out whether teachers characteristics influence their attitude and preparedness to Information Communication Technology integration in their classroom practice. The study investigated the influence of teachers' characteristics on their attitude and preparedness to integrate ICT in primary school mathematics instruction in Nakuru East Sub-county of Nakuru County. In the study, a Correlational research design was applied. A total of 1364 primary school teachers in Nakuru East Sub-County, was the study's target population. The accessible population were all the mathematics teachers from the public primary schools from which a sample size of 140 participants took part in the research. The sample was chosen using simple random sampling of the five divisions and participating schools in each division and proportionate stratified sampling of teachers by gender in each school. The head teachers in the participating schools were selected purposefully as part of the teachers. The data were collected using a self-report questionnaire. The department of curriculum Instruction and Education Management experts of Egerton University improved the validity of the instrument. The tool was pilot tested to measure the reliability coefficient of the instruments. The reliability of the research instrument was 0.906 which was within acceptable threshold. Descriptive (means, percentages and frequency distributions) and inferential statistics (correlation and regression analysis) were used to analyze the collected data with the help of SPSS program version 26. The research hypotheses were tested at 0.05 Alpha (α) level. The research established a strong statistically significant positive relationship (r = 0.879, $p < 0.05$) among teacher characteristics and attitude towards the integration of ICT in mathematics instruction. Moreover, the study revealed a significant strong positive correlation (r = 0.634, $p < 0.05$ among the teacher characteristics and teacher preparedness to integrate ICT in mathematics instruction. The findings may help in informing policymakers and teacher trainers to include ICT in training programs. The study recommends more research be done in public primary schools in other counties to establish whether the findings are the same.

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LIST OF ABBREVIATIONS AND ACRONYMS

BECTA: British Educational Communications and Technology Agency

ECDE: Early Childhood Development Education

ICT: Information and Communication Technology

ISTE: International Society for Technology in Education

KEMI: Kenya Education Management Institute

KICD: Kenya Institute of Curriculum Development

KIE: Kenya Institute of Education

KNEC: Kenya National Examinations Council

MDG: Millennium Development Goals

MOEST: Ministry of Education Science and Technology

NCTM: National Council of Teachers of Mathematics

NEPAD: New Partnership for African Development

NESC: National Economic and Social Council of Kenya

PBC: Perceived Behavior Control

SETDA: State Education Technology Directors Association

SPSS: Statistical Packages for Social Sciences

ST&I: Science, Technology and Innovation

TAM: Technological Acceptance Model

TPACK: Technological Pedagogical and Content Knowledge

TPB: Theory of Planned Behavior

TQ: Teacher Questionnaire

TTA: Teacher Training Agency

UNESCO: United Nations Educational, Scientific and Cultural Organization

WSIS: World Summit on the Information Societies

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

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In 2003 World Summit on the Information Society (WSIS) was held in Geneva, and later Tunis 2005. It brought about a clear commitment by governments to foster the accomplishment of a comprehensive information society and the promotion of Information and Communication Technology (ICT) use towards internationally agreed 2030 agenda for Sustainable Development (Canazza, 2018). Moreover, the International Telecommunication Union (ITU) and the United Nations Educational, Scientific and Cultural Organization (UNESCO) have been spearheading and encouraging the combination of the powerful impact on the Information and Communication Technologies in anticipation for the achievement of 2015 internationally approved Sustainable Development Goals (SDGs). The WSIS plan of action captured the goals which seek to redress upcoming information society issues at international regional and national levels (World Summit on Information Society, 2003). The ten identified targets by WSIS were to be attained by 2015, two related to education. Their second objective was to link all primary schools to information and communication technology. The seventh one was on adapting all primary schools' curriculum to encounter the information society's issues (Partnership on Measuring ICT for Development, 2011).

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Information and Communication Technology is defined as resources and a varied combination of technological tools (software) used to store, create, disseminate, manage and communicate information (Bhattacharjee & Deb, 2016). Similarly, ICT is the technology that comprises electronic devices and related `human interactive materials that assist the teacher in applying them for a wide range of learning and teaching process (State Education Technology Directors Association (SETDA), 2015). According to Preiner (2008), ICT is significant in education because of its desirability, speed, capacity, and automatic functions.

Information and Communication Technology endures advance in Asian and Western nations, African nation are still striving to implement ICT policies, and these widen the digital and knowledge divides (Kinuthia, 2009; Reffel &Whitworth, 2010). A new partnership for African Development (NEPAD) was introduced to redress problems affecting Africa and has recognized ICT infrastructure as a significant area for inducement of situations for sustainable development (NEPAD, 2012). NEPAD identified six areas of high significance.

Among these was the e-schools programed by NEPAD, whose aim is to integrate ICT in educational curriculum distribution at primary and secondary school levels to increase accessibility, equity and equality in education among its member states Kenya included. The operation plan envisions the coverage of primary schools in ten years (Michura, 2019).

According to Hockly and Dudeney (2018), the vision 2030 envisions to have research universally for sustainable development and competitive quality education training achieved by reducing literacy by increasing access to education. Other goals are capitalizing on knowledge in Science Technology and Innovations (ST&I). To ensure that it is on the right track in realizing its economic objectives, Kenya's government embraced an ambitious project of introducing one laptop per child in standard one in the year 2014 (MOEST,2010). The Kenya Government through the Ministry of Education Science and Technology was credited with the responsibility of providing a quality education that empowers students to operate within a highly incorporated technologically–oriented information-based global economy aggressively. To achieve this Kenya is guided by the following frameworks (ICT Authority Board, 2016).

i) National ICT policy 2006 on improving living status of Kenyans by guaranteeing the availability of efficient accessible, affordable and reliable ICT services
ii) Constitution of Kenya 2010
iii) Kenya vision 2030 blue print through Medium Term Plan (MTPs) iv) Kenya Institute of Curriculum Development (KICD) act 2013

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The national Information and Communication Technology policy's main objective was to assist in poverty eradication and economic development through efficient technologies. In human resources development, the system emphasized incorporating ICT in delivering the curriculum at all levels educational (Kinyanjui, 2019).

In Kenya, the inclusion of ICT in the education program was handed over to the Ministry of Education Science and Technology (MOEST) in May 2013; (MOEST, 2013). The MOEST, in turn, has given the mandate to Kenya Institute of Curriculum Development (KICD) previously known as Kenya Institute of Education (KIE), to prepare the ICT curriculum, distribute educational materials and take charge of controlling other institutions that develop suitable digital content (Kairo, 2013). The KICD has generated digital content for most subjects in primary and secondary school education. The approved digital content is cataloged in the orange book, which contained the recommended textbooks and other learning and teaching materials by MOEST for ECDE, Primary, secondary, and teacher education in Kenya. This digital content has been developed for commercial purposes, and schools have to procure it (MOEST, 2013).

Integration of ICT in teaching and learning method aims at utilizing ICT to increase access to education, allow multi-sensory learning, boost students self- confidence and stimulate sensory and cognitive curiosity, promote learner-centered approach, active, integrative, creative, evaluative and enhance different learning pathways (Intel, 2012). A study by Bledsoe (2018) stresses that learners have to have in depth knowledge of subjects in school and the required skills to respond to limitless 21st century skills. The 21st century learner should be ICT savvy, adept and technology literate, flexible and dynamic, media savvy interactive and networked, communicators and collaborators, reflective and critical, lifelong learners and should have multi modal learning styles (Education Origami, 2015).

The success of ICT in education relies upon how they are initiated into the system. According to Haddad (2013) some of the options for introducing ICT are: ICT can be applied as an extra layer of educational input and does not interfere with the current system but instead it supplements software and hardware and software for improvement. The issue here is that teachers may not know how to relate them to the existing program or take the additional materials seriously.

Secondly ICT can be considered as an essential part of the remaining teaching system. This procedure comprises translating objectives, articulating learning standards into learning and teaching process, training staff, generating multimedia curriculum materials, establishing a distributing communication network, evaluating learning accomplishment, and evaluating the program. Here I CT's integration into teaching is not an ancillary for the classroom scenery but rather improves the teacher's facilitation role and the part of pupils as a participant in the learning process.

Kenyan primary schools' teachers are required to teach all subjects in the syllabus. As a result, teachers are responsible for delivering content to their pupils and developing new ways of learning. The teaching profession is challenged to create new ways of teaching (Esptein, 2018). The Syllabus is revised as new ways of teaching are developed. The latest revision of the primary school syllabus in Kenya was 2008 to accommodate some change. The integration of Information and Communication Technology in learning and teaching process is one of the changes. Instructors in different categories are expected to incorporate modern technology into their instruction process to attain their goals and raise the education quality (Andoh, 2012; Mingaine, 2013).

When appropriately used ICT's can assist in increasing accessibility to education, strengthening education relevance to a progressive digital workplace, and improve quality by being a tool, a tutor and a simulator that allows mathematics students exploration and testing of ideas (Pritchard et al., 2019). In the past, the critical description for a motionless technologically free classroom is the lack of adequate resources in terms of hardware and software. According to Communication Commission of Kenya (2013), the current Kenya government promised all public primary schools one laptop for every class one pupil by 2017. At the moment, the MOEST has allocated funds for improving infrastructure (access to electricity and building computer labs), and equipping was done (ICT Authority Board, 2016). Some of the obstacles to integration of Information and Communication Technology in learning and teaching are intrinsic to the teacher, and its extent is not known. Therefore, it compels the researcher to set out and investigate whether primary school teachers are ready to embrace Information and Communication Technology integration in learning and teaching. The researcher intends to establish the Influence of teachers' Characteristics on their preparedness and attitude to integrate Information and Communication Technology in primary school mathematics teaching.

1.2 Statement of the Problem

The world we are living in keeps on changing due to Information and Communication Technology. Its effects in modern society are felt globally at the workplace, leisure, and human relations. Digital literacy is presumed to play an essential role in our future lives. Technology empowers teachers and the challenge for education is to improve technical skills among teachers to assist them in delivering content efficiently and effectively in a school setting. Primary schools have to be well-suited equipped with the technology and ever-expanding knowledge to deal with this cognition. Television, telephony and radio, in addition to the internet and computers and other information and communication technologies, have proven as possibly powerful tools that teachers can use for educational change and reform. Research has shown that Teachers' characteristics which includes qualification, teaching

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experience, and ICT training may influence in the integration of ICT in teaching and learning. This study sought to investigate how mathematics teacher qualification, teaching experience and ICT training influence on their attitude and preparedness to integrate Information and Communication Technology in public primary schools' mathematics instruction of Nakuru East sub-county Kenya. It sought to determine whether teacher characteristics influence significantly on their attitude and preparedness towards ICT integration.

1.3 Purpose of the Study

The purpose of this research was to investigate the influence of public primary school teachers' characteristics on their attitude and preparedness to integrate Information and Communication Technology in mathematics teaching.

1.4 Objectives of the Study

This study was guided by the following objectives.

i). To establish the influence of teachers' characteristics on their attitude towards the integration of ICT in mathematics instruction.

ii). To establish the influence of teachers' characteristics on their preparedness to integrate ICT in mathematics instruction.

1.5 Hypothesis of the Study

H_{01}: There is no statistically significant influence of teachers' characteristics on their attitude to integrate ICT in mathematics instruction.

H_{02}: There is no statistically significant influence of teachers' characteristics on their preparedness to integrate ICT in mathematics instruction.

1.6 Significance of the Study

This research's outcome may assist in showing teachers' attitudes and perceived readiness to integrate ICT in primary school mathematics teaching. Policymakers may use the information to identify ICT integration challenges among teachers, offer solutions, and design ways through which ICT may be integrated into teaching primary school mathematics. The study's findings may also enable the MOE, QUASO, and KICD to come up with appropriate measures to make sure that schools are well equipped to embrace Information and Communication Technology incorporation into the learning and teaching mathematics in

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primary schools. Such measures include providing schools with ICT infrastructural resources and training of teachers and technicians. This research's outcomes may help teachers re-evaluate their competencies in preparation for ICT integration in mathematics classrooms. Adequately prepared teachers may contribute to the success of any educational program implementation in schools.

1.7 Scope of the Study

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The study involved all public primary schools' mathematics teachers of the Nakuru East sub-county. Those who participated included Certificate holders, diploma holders, Graduate teachers and Post-Graduate teachers teaching in primary schools. The study involved 140 teachers randomly selected from schools identified from each division.

1.8 Limitation of the Study

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The limitation of this study is its susceptibility, in which respondents incline to give preferable responses that make them look good or appear to be what the researcher is looking for.

1.9 Assumptions of the Study

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In this research, the assumption was that the respondents had similar characteristics irrespective of their location that is, whether in rural or urban areas due to similar training exposure in Kenya.

1.10 Operational Definition of Terms

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Attitude: An attitude is a mental and neural state of readiness that has been organized through experience and exerts a directive or dynamic influence on the way an individual respond to all objects and situations with which it is associated (Lone, 2019). In this study attitude refers to teachers' expression of favor or disfavor towards ICT integration into mathematics instruction.

Competency: is defined as the ability to do something successfully or efficiently (From, 2017). In this study, it implies the skills, knowledge, and understanding needed to integrate Information and Communication Technology into mathematics teaching successfully.

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ICT preparedness of teachers: Preparedness is the state of being ready for a particular situation. It refers to the ability to use laptops and computers (Lawrence & Tar, 2018). In this study ICT preparedness refers to the readiness of mathematics teachers to integrate ICT in their teaching practice.

Information Communication Technology (ICT): Is an umbrella term that encompasses all communication technologies which includes the wireless networks, internet cellphones, digital television, satellite communication computer and network hardware and software as well as equipment and services associated with these technologies, including emails, blogs, and others that provide an access to information (Tony, 2018). In this study, it will refer to teachers use of computer software's, computer as a tool for teaching and analyzing data and internet search for teaching mathematics content by teachers

Integration of ICT in mathematics instruction: Using ICT tools which comprises computer software (for example spreadsheet, publications, and presentation software, word processing, multimedia, databases, e-mail and web browsers) during teaching and giving students assignments (Wanjala, 2016). In this study Integration of ICT in mathematics instruction refers to the use of laptops and computers in the course of education to improve the learning quality in a classroom by teachers.

Mathematics instruction: Is a complex teaching and learning process in which Educators attempt to make abstract concepts tangible, challenging ideas understandable and multifaceted problems in mathematics solvable by a learner (Botha et al., 2019). In this study mathematics instruction refers to teaching and learning process where teachers try to simplify challenging and multifaceted ideas in mathematics that a student can solve easily.

Pedagogy: The theory and practice of teaching, the strategies used to teach, the specific interaction of teacher and students, the instructive content used the combined goals of the learner and teacher, and the manner in which the content is presented and delivered to the learner are all included in the definition of pedagogy (Nilsson & Karlsson, 2019). In this study it describes the study of teaching, and how content is presented and delivered to a learner.

Teacher characteristics: a feature or quality belonging typically to an individual or a thing and serving to identify it. A distinguishing feature or attribute of an item or a person. In this study, it refers to qualification, teaching experience and teachers ICT training.

Teacher qualification: refers to the minimal academic requirements for teaching their subjects at the appropriate level in a particular country (Bold et al., 2017). In this study it refers to qualified teachers who has the ability to use computer and internet use in teaching mathematics subject in primary school.

Teaching experience: refers to the number of years spent regularly meeting with students, planning and delivering instruction, developing or preparing instructional materials, and evaluating student performance (Kim & Seo, 2018). In this study it refers to the years one has been teaching mathematics in primary school.

ICT Training: Refers to computer and internet courses and qualifications that an individual undertake and receive to enhance ability to use computer and internet efficiently (Nath, 2019). In this study it refers to computer and internet courses and qualifications that teachers undertake to enhance ability to use computer and internet in teaching mathematics subject in primary school.

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CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter outlines a review of literature in mathematics education that is associated with the study either directly or indirectly. It explains technology approaches in the classroom; Application of Information and Communication Technology in teaching mathematics; Mathematics teachers' ICT preparedness, teacher characteristics that may influence their use in teaching of ICT and finally, the conceptual and theoretical framework of the research. The literature is reviewed under the themes derived from objectives as follows: influence of teaching experience, qualification, level of ICT training on teachers' attitude and preparedness.

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2.2 ICT Use in Education

According to Sartori et al. (2019), Information and Communication Technology is an umbrella word that comprises any communication appliance or device, comprising: Cellular phones, computer, television, radio, software, hardware and network. Geer and Sweeney (2012) defined Information and Communication Technology in education as a learning and teaching the subject matter that permits comprehension of the effective use and functions of ICT.

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Teaching 21st-century students necessitates robust pedagogy. Traditional Pedagogy methodologies have led to a deviation between what to train to the scholars and what the industry requires. Intrinsically numerous schools are shifting towards problem-based education as an answer to making learners who are inventive to solve problems, especially in mathematics (Ibrahim & Asiedu-Addo, 2019). The pedagogy empowered by ICT offers challenge-based learning, which helps mathematics students be independent, and have critical thinking. The use of ICT enables teacher's especially mathematics teachers, to cultivate strategies that stimulate profound knowledge, which results in a learner-centered environment. The influence of ICTs on learning can be advanced in several ways to encounter the need of students. Inversely from outdated pedagogy that has a specific way of teaching (uninterrupted flow of information from tutor to the scholars) ICT's involve varieties of models in training and learning. Varied forms of ICTs use are computer-aided applications, web-training, digital training, online computer training, virtual education, visualization software, eLearning, etc. All these methods of ICTs have changed the role of a trainer to that of a facilitator especially in mathematics classes (Radhakrishnan et al., 2018). According to MOEST (2013), the implementation of laptop project in Kenya for standard one class in primary schools, with embedded technology throughout the curriculum to first enhance learning and teaching by applying a range of technologies to provide for various learning approaches (techniques) that will allow learners to team up with partner and peer schools. According to UNESCO (2004b), teachers use three critical methods to Information and Communication Technology specifically; enhancement approach, integrated approach and complementary approach;.

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The integrated approach involves planning the application of Information and Communication Technology within the subject to improve specific approaches, skills, and improve learners' achievement. In this approach, the students encounter issues to their general knowledge and are given more profound perceptions into mathematics subjects. According to Bush et al. (2018), ICT accessibility has transformed the nature of learning and teaching in mathematics. A range of portable devices exist, enabling students to gather and manipulate data using databases and spreadsheets. Multimedia software programs emphasize individual units of research, bringing sound, dynamic movement and graphics to students learning. The calculators have become more progressive, permitting users to perform progressively challenging functions. Programmable toys or floor robots controlled by instructions in programming languages (usually Logo), were the earliest applications of Information and Communication Technology to mathematics. They were the reason for essential variations in teaching mathematics.

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Enhancement approaches involve planning the use of an ICT resource to develop or complement the prevailing mathematics lesson and topic with an inventive presentation method to encourage class visualization and discussion of the problem. This concept could advance pupils learning through presenting knowledge in new ways, encourages them to formulate their explanations and to promote discussion among learners. Computerized graphing and graphic calculators in mathematics speeds up, freeing individual to analyze graphing process and reflect on the relationships among data (UNESCO-UIS, 2012). Specialists' software which included Dynamic Geometry Systems (DGS), Computer Algebra System(CAS) and Mathematics curriculum software improves students' understanding algebraic skills, permits students to measure and manipulate shapes leading to a higher level

Formatted: Space Before: 0 pt, After: 0 pt of learning among them (UNESCOUIS, 2014b). Logo inspires students to improve problem-solving skills, causes them to make higher level of mathematical thinking as well as learn geometric approaches (UNESCO-UIS,2014a). According to UNESCO-UIS (2013) Constructivist pedagogy is supported by Information and Communication Technology and it allows pupils to explore and understand mathematics approaches. This concept encourages better problem-solving strategies and higher-order thinking (OECD, 2014). Das (2019) reiterated that teachers could maximize the influence of ICT in mathematics teaching by using Information and Communication Technology instrument in working towards the attainment of learning objectives. Complementary approach: It involves the usage of ICT resources to empower the pupils learning. Instructors use the Information and Communication Technology for different functions to improve learning and teaching, comprising playing games, general communication, looking for data, doing homework and drilling and practicing mathematics (OECD, 2014). Simultaneously, information and Communication Technology have transform the teaching context that needs teachers to achieve evolving learning and teaching paradigms and associated processes efficiently. Beyond using Information and Communication Technology to improve another curriculum, several teachers use Information and Communication Technology to teach essential computing and computer skills.

Secondly, ICT use improves administration and planning using technology to share information and enhance the teacher's knowledge of the subject area and develop their professional issues around the subject for learning and teaching. Information and Communication Technology is used to improve assessment and report by recording learner's attainment and achievement electronically. Tracking students' progress and using this information in assessment for communication and learning with parents through email, school learning flat form, and new record-keeping software. The teacher must have widespread knowledge of Information and Communication Technology to be capable of fitting its use into their prevailing pedagogy or extending their pedagogical expertise so that they can accommodate ICT adequately in their teaching.

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2.3 Teachers' Use of ICT in Mathematics Classroom

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Effective teachers improve the likelihood of technology to improve pupils' knowledge of how to increase proficiency and stimulate interest in mathematics. Whenever teachers deliberately embrace technology, they can offer higher accessibility to mathematics for all pupils. Teachers incorporate Information and Communication Technology in learning and teaching mathematics because of its desirability, automation, capacity and range (Ayiema et al. 2019).

According to Preiner (2008), there are two forms of integrating ICT in mathematics teaching, namely: Use of Visual manipulative; and the use of mathematical software tools. Visual manipulative tools consist of a specific interactive learning environment that allows students to explore mathematics approaches devoid of special computer knowledge or skills on specific educational software packages. Mathematical software tools are suitable for educational functions. The software can be for a broader range of accurate content topics. These soft wares allow flexibility, enables students and teachers to explore mathematical concepts. There is a variety of mathematical software in education. Teachers should consider the pedagogical, precise, and organizational aspects of software when choosing it (Trigalova & Tabach, 2018).

2.3.1 Classification of Software

According to Mahabir et al. (2017), four classifications of software according to their use are:

~~I).~~i. Tutor (teaching) software: They are intended to be applied repeatedly (drill and practice) and can look like a textbook where various examples of training provided. It provides knowledge to the students who can have a minimum degree of control. The program does not have the possibility of transforming learning and teaching but can do the equivalent that traditional schools have done, possibly more efficiently and systematically (Pritchard et al., 2019).

~~II).~~ii. Simulation (revelatory) software: it put the user in diverse fictional context or construction of a real condition. The user attempts to determine rules and variables by trial and error and feedback.

~~III).~~iii. Tool software (Emancipator): It permits specific jobs which includes, drawing, writing and communication to be used more quickly. This gives the learners more time to be productive in the interpretation, presentation and analysis of information.

~~IV).~~iv. Conjectural software: This software allows manipulation, exploration and testing of ideas, which assist the learner to set up their models and test hypothesis, for example, the logo.

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According to Githua and Njubi (2013), due to technological advancement, mathematics education has significantly transformed. ICT use allows visualization of mathematics situations, simple computation and interactions that facilitate learners to comprehend improved mathematical approaches in Practice. ICT can be a tool for pupils to mathematical model interactions in practical circumstances.

Technology is an essential tool for learning mathematics in the 21^{st} century; it cannot substitute computational fluency, conceptual understanding or problem-solving skills. Technological tools comprise both the content-specific technologies (for instance, computational devices and computer programs) and content-neutral technologies, including collaboration and communication tools (Guerrero, 2010). Since there are various mathematical softwares in mathematics education, teachers should consider the following mathematical, pedagogical and organizational aspects. Educational, technological issues related to the software's competency to assist in teaching, strengthen skills, improve knowledge and Practice and enhance understanding mathematical technical problems related to the mathematical capabilities of the software. Organizational ICT problems refer to the software's capacity to generate materials more effectively, find resources and manage time. This software is either content-specific curriculum software, content-free software, subject-specific software, or data handling software (Preiner, 2008).

Content-specific technologies in mathematics education comprise computer-based applications, computer algebra systems, data collection, handheld computation, dynamic geometry environments and analysis devices and interactive applets (Gadanidis & Geigner, 2010). These technologies assist learners in identifying and exploring mathematical approaches and relationships. Outcomes from numerous researches have revealed that the strategic use of technological tools can help develop advanced mathematical proficiencies and the learning of mathematical procedures and skills, which includes reasoning, justifying and problem-solving (Pierce & Stacey, 2010). Content-free methods comprise collaboration and communication tools and Web-based digital media. These technologies improve the pupils' accessibility to ideas, information, and relations that help improve sense-making, which is central to taking ownership of knowledge.

In an objective mathematics curriculum, the planned technology use reinforces mathematics learning and teaching (Dick & Hollebrands, 2011). Accessibility to technology is not adequate. The curriculum and the teacher play essential roles in interceding technology's application (Chale, 2018). According to the International Society for Technology in Education (ISTE) (2008), curriculum developers and teachers must be skilled in finding out when and how technology can improve pupils' learning effectively and appropriately and be knowledgeable decision-makers. All mathematics programs and schools should offer teachers and pupils access to teaching technology that comprises lab-based and handheld devices with mathematical software and applications, classroom hardware and Web-based resources together with sufficient training to make sure ICTs efficient usage. According to Bock and Leavitt (2018), students should have perpetual agility to see the patterns in several ways and abandon those that are not useful. With the support of ICTs, it was easier for students that explore to produce a general law that mathematically translates the underlying model structure. Professional development and teacher education programs must repeatedly update teacher practitioners' knowledge of technology and its application to promote learning activities. The use of these tools maximizes the possibilities afforded by students' increasing knowledge about, enriching students' experiences as learners of mathematics and comfort with the technology-driven method of information retrieval and communication stimulate them into making their thinking visible in making their own experience (Project-Tomorrow, 2011). Additionally, the work with practitioners should comprise the development of mathematics lessons that take advantage of the integration of digital tools in daily teaching and technology-rich environments, its potential impact on students' understanding and use of mathematics and instilling an appreciation for the power of technology (Nelson et al., 2009; Pierce & Stacey, 2010).

In a primary school classroom, teachers use concrete manipulatives such as Geo board or Dienes Block. To make geometric figures Geoboards are used by stretching a rubber band.

Diene’s block is a physical model of place value. As they continue learning, they use more sophisticated models to help students learn by giving abstract ideas a more tangible form and supporting computation. Researchers have established that that while physical manipulative is the real right form for primary schools, Information Communication Technology based tools are the correct real form for secondary school (Tabira & Otieno, 2017). The Teacher Training Agency (TTA) of England suggests that Information and Communication Technology can help students practice and consolidate number skills, exploration experimentation, interpretation discussion, description, or explanation of number patterns. These will help the students to develop logical thinking and make connections within and

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across mathematics areas, aids in developing visual and mental imagery that enable them to reason and write simple mathematical procedures (TTA, 1999).

When students see things occur dynamically, they will understand deeply shapes and their relationship to each other than if they hear only, experienced a static version of the same phenomena (Hennink et al., 2020). According to the study by Sherwood and Pearson (2010), visual imagery may contribute to generating different rules will enhance connections between arithmetic and geometric relationship; assigning meaning to formulated rules; the need to form and validate conjectures.

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Researchers have established that ICT can support learning when suitably incorporated with curriculum, assessment and teaching techniques (Means & Haertel, 2004). Successful integration of ICT will focus learners thinking and make mathematical ideas tangible during mathematics teaching. Since there is a variety of accurate software, the Kenyan primary school teacher is supposed to have prior knowledge of the software's mathematical, pedagogical, and organizational aspects. This knowledge will help individual teachers choose the appropriate software to use in integrating ICTs in mathematics classrooms.

2.3.2 Focusing Learners Thinking

The attention spans for primary pupils are limited. The learners cannot keep track of problem-solving and may experience thinking complications in the tools and materials they use. Teachers can use technology to direct learner's activity to think that it is relevant and not extraneous to what they should be teaching (Ellington, 2003).

In primary schools, mathematics should be studied fluently to avoid cognitive load (thinking difficulties). When using technology learner's activity should be directed to achieve computational support for lower thinking to offload details computations and to allow teachers to focus better on:

i). Relevant or more realistic problems.

ii). Sense-making and exploration with numerous representations.

iii). Development of flexible approaches and mathematic concepts and meaning (Keong et al., 2008). Modern ICT's not only handled arithmetic details but also graphing, transform algebraic expression, and geometric computing properties.

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2.3.3 Making Ideas Tangible

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According to Piaget (1970), youngsters will initially develop thoughts precisely before they advance to abstractions. Teachers should design the learning environment by applying Piaget's principle and providing students with more tangible visualizations (Bizzaro *et al.*, 2018). According to Campell (2019), researchers have established that technology makes abstract notions visible, thus allowing teachers to move quickly to:

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i). Build upon pupil's preceding skills and knowledge.

ii). Put emphases on the relation between real-world settings to mathematical concepts connect abstract things.

iii). Address common misconceptions.

iv). Present more progressive thoughts.

2.3.4 Teaching Mathematics Better

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Integrating ICT into the classroom can develop mathematics teaching. Teachers can use technology to present mathematics well and add more advanced mathematical topics earlier because they focus less on memorizing facts, justifying solutions, and understanding connections (DeBoer, 2019). To minimize the digital divide between nations at the national level, numerous rushes provide computers to schools to demonstrate that the government is working hard (Dada, 2006). Statistics show that government ICT projects in developing nations, 15% of them show success, 50% partial failures and 35% failures (Ondego & Moturi, 2016).

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According to Mangwende and Maharaj (2020), the application of ICT in learning and teaching may encounter several glitches. These glitches are also known as the barriers. The barrier is any circumstance that makes it challenging for advancement or attaining a stated objective (Khan et al., 2012). These barriers are classified by Donnelly et al. (2011) into two groups' external obstacles as the first order and intrinsic barriers as the second order. The first-order barriers consist mostly of those hindrances extrinsic to teachers and generally comprise lack of adequate time, accessibility to technology, resources, training and support (Ertmer, 1999). It is instead economical than the pedagogical problem that was the primary explanation for a tranquil technological free classroom. But the on-going propagation of digital devices and the now universal presence of smartphones and tablets laptops between teachers and pupils appear to contradict this already (Ertmer & Ottenbreit-eftwich, 2012). It is thus interesting to take a closer look at those second-order barriers that are rooted in teachers' underlying beliefs about learning and teaching that inhibit or delay fundamental change (Ertmer & Ottenbreit-eftwich, 2012). Second-order obstacles comprise teachers' beliefs, confidence, attitude, practices, and resistance to change. ICT can be very time-consuming. Teachers who trained during analog time fear ICT and are intimidated or overwhelmed by the technological change. Brudvig (2019) explains that it is not easy for teachers who are outdated to prepare pupils for tomorrow's challenges.

The intrinsic barriers can be in three different pedagogical knowledge areas and cultural dependencies (Rowston et al., 2019). Experience in this context implies more than just how to use specific hard and software, but rather a precise pedagogical understanding of how to address pupils' requirements with technology.

Koehler and Mishra (2009) described the inherent problems in their Technology Pedagogical and Content Knowledge (TPACK) model, which emphasizes the requirement to combine general pedagogical skills with the capacity to use technology and the particular content of their respective subjects. The first order barriers leave teachers without any choices access, accessibility of resources, and teachers' training is in the hands of the policymakers and the institution, which the teacher has no control. According to Tondeur et al. (2012), the idea behind TPACK is to allow teachers to be capable of teaching with technology in the classroom and making workable choices in their uses of technology when teaching specific content to a particular target group".

In Kenya, the ministry of education science and technology is in charge of developing institutional, infrastructural frameworks and capacity building for learning and teaching. There is an excellent effort to develop ICT in education in both private and public sectors, as demonstrated by the government's 1st phase of funding for developing infrastructure in primary schools for ICT in the year 2014. An improvement for the government of Kenya because it has gone without any significant use of the robust solutions that computers can provide (Hennesty et al., 2010). Kenya is attempting to provide necessary access to education while updating technology literacy within its curriculum (Langmia, 2006; Wims & Lawler, 2007).This study will focus on teachers' characteristics, preparedness and attitudes to integrate ICT in mathematics teaching; therefore, the researcher will analyze the teacher's characteristics attitude and readiness.

2.4 Mathematics Teacher ICT preparedness

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According to Malik(2018), the teaching profession has been challenged as teachers are responsible for delivering content to their pupils and developing new ways of learning. Primary-school teachers are change agents. They assist to mold kids' foundation personalities and skills in mathematics. Technology is an additional area where instructors work as change agents provided that teachers are critical to the achievement of the laptop project in Kenya as well as the awareness of the projected curriculum and the transmission of 21st-century competencies and skills to pupils (Huda & Teh, 2018).

2.4.1 Competencies that Teachers Require

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Technology is changing the way students learn and teachers work. Therefore, for teachers to prepare today's students adequately for tomorrow, they must-have 21st century skills. According to Hilton (2008), an ICT teacher's competencies are categorized into three groups: Literacy skills, life skills and learning skills. The literacy skills need teachers and students to publish outlets, discern facts and technology. Teachers should understand points, find truths and understand what gadgets perform what tasks and why. Life skills encompass productivity, social skills, flexibility, leadership and initiative. In this category, the teacher should be capable of adapting to the varying circumstances of the student. Learning skills require a teacher to impart skills of critical thinking, creativity, collaboration, and communication. In this category, Teachers should teach students about the mental processes needed to improve and adapt to the work environment.

Since instructors are the leading implementers of formal education and at the front line of technology programs, their roles will change from a distributor of knowledge to an orchestrator of assisting pupils and learning to turn information into experience and insight into wisdom (2nd International conference on education proceedings, 2011).

2.4.2 Preparation of Teachers in ICT for Teaching Mathematics.

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According to Olika et al. (2019), teachers need to be equipped with the essential skills to incorporate ICTs efficiently. Teachers' skills impact how much they can incorporate ICT with pedagogical skills to efficiently change the pupil's Information and Communication Technology skills and accomplishment. Teacher Training programs can be revised to integrate ICT programs to provide them with the technical skills required to incorporate Information and Communication Technology in teaching. Lim and Pannen (2012) stated that teacher training could take a peer training method where experienced teachers in ICTs will train their peers. According to Intel (2012), Teachers require preparation on the following:

ICT training – there is necessity to train on how to use software and hardware programs and all other additional materials. This knowledge-based system is critical to teachers' productive use of computers and their feeling of empowerment to use computers. ICT training will empower teachers with computer competencies and confidence. That is being capable of handling a more comprehensive range of changing computer applications for numerous functions.

Kenya's government is cognizant of the vital role that an Information and Communication Technology system play in propelling the nation to an industrialized economy. Teachers play a critical role since they are at the Centre of any educational reforms (Bikos & Tzifopoulous, 2012). Through the sessional paper no 14 of 2012, the Kenyan government identifies the role of teachers in integrating ICT in the education systems by demanding all education managers and teachers to be literate in ICT by the year 2015 (ICT Authority Board, 2016).

Teachers who have attained some ICT skills are greatly assured and might integrate ICT in their classroom work than those who are not informed on ICT application. According to Agbatogun (2010), untrained teachers in ICT skills are likely to suffer from techno phobia which may curb an array of the ICT learning and teaching resources at their disposal. Therefore Kenyan primary school teachers should be knowledgeable in how to integrate and use technology in their pedagogy. Train teachers feel comfortable with technology only if they possess the necessary ICT skills and ICT based teaching methods (Nyakowa, 2014).

Teachers also require pedagogical training: To apply technology to enable pupil learning, teachers require extra skills and knowledge. Pedagogy refers to the "interactions among students, teachers, learning tasks, and the learning environment (Harlen, 2018). The conceptualization of extra knowledge has been done in various ways (Lee & Capraro, 2018). According to Angeli and Valanides (2009) effective integration technology relies on a concern of the relations between content, technology and pedagogy. Explicitly, technology incorporation demands that in-service and pre teachers recognize: (a) that technology tools themselves joined with (b) the particular affordances of each device that, when used to demonstrate content, aid complex ideas to be understood easily, hence ensuing to the attainment of significant pupil results.

According to MOEST (2013), ICT integration is built on four pillars. Namely: overall view/policy of education being relevant; teachers' expertise; availability of digital learning materials; and adequate ICT infrastructure illustrated in Figure 1.

Figure 1: Four pillars of ICT integration into teaching and learning
Source: KEMI distance learning module 5

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The diagram shows how schools can get the most out of ICT. According to (Lawrence & Tar, 2018), the four pillars of ICT integration describe the basic elements. The building blocks-that must balance with one another before teachers can use ICT effectively and derive the benefits they want to use ICT to provide quality education. They are achieved through the collaboration and support of all stakeholders.

Overall View / Policy is a pillar that refers to government strategy with particular relevancy to teachers' capacity building in ICT (Lievens *et al*., 2018). According to Elbaz (2018), expertise pillar refers to the basis of the reliability of an individual who is alleged to be knowledgeable in a topic or an area like ICT owing to his training, research or experience in the subject matter.

The Digital learning pillar is any learning that is complemented by technology or teaching practice that makes effective use of technology (Collins and Halverson, 2018). It consists of the application of a wide range of methods, including combined and virtual learning. A digital learning approach includes any of the following: badging and gamification, blended learning, adaptive learning, classroom technologies mobile learning, e-textbooks, online learning (or e-learning), technology-enhanced teaching and learning.

The ICT infrastructure pillar incorporates all the protocols, procedures, networks, and devices employed in the information technology or telecom fields to foster interaction amongst different stakeholders, including the education sector (Ray, 2018).

The above four pillars shown in figure 1 are hold up by leadership from the National, County, Sub-County, zone, School to Classroom level, collaboration, and support from various stakeholders and partners (ecosystem). The extent to which the four pillars' components are implemented in schools determines the effectiveness of ICT integration in Kenyan primary schools. ICT should be incorporated in teaching and learning to improve pupil engagement in significant learning to accomplish curriculum objectives without any negative impact or complication. Proper use of ICT in mathematics teaching offers; increased motivation, improved performance and a streamlined learning process that ensures that pupils can learn more and better. The study will determine whether teachers are trained on how to develop ICT seamless, integrated lessons and whether they have the necessary teacher education management skills to steer ICT integration in primary school mathematics.

The MOEST also adopted Mishra and Koehler's Technological, Pedagogical and Content Knowledge (TPACK) model of ICT integration into teaching and learning are shown in Figure 2.

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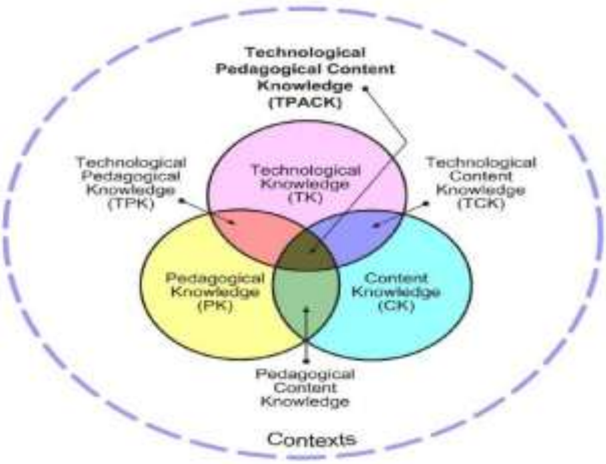

Figure 2: Effective ICT integration-TPACK model

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Source: Mishra and Koehler (2009)

Effective incorporation of ICT into learning and teaching according to the TPACK Model consists of a combination of three specific domains of knowledge. These are: Subject matter (Content), Pedagogy and Technology. The three elements must be actively interacting at all times for the full benefits of ICT integration as illustrated in Figure 2. The TPACK) model was initially described by Mishra and Koehler (2006). According to Mishra and Koehler (2006), for efficient integration of ICT in education, teachers should acquire knowledge from the three domains, technological (T), Pedagogical (P), Content (C), and knowledge, teaching strategies and techniques, and the digital and non-digital technologies and tools.

TPACK will offer suitable basic premise in the training of primary mathematics teachers for ICT incorporation in their teaching and learning teachings. The establishing and understanding the relationship among pedagogy, subject content and technology is essential for effective integration and the basis of TPACK.

Technological Content Knowledge (TCK) Incorporates the specific technological environments to transform issues of science subjects. For example, the changes like science technology convey tools and new methods applied in solving science problems, the application of simulation software in physics and modeling methods in science.
Pedagogical Content Knowledge (PCK) comprises educational techniques and strategies illustration and formulation of scientific approaches knowledge of what makes those approaches difficulty or easily understood knowledge of pupils' misunderstandings. Prior experience or reasoning challenges, knowledge of students' theories of epistemology; i.e. Understanding the best practices for teaching specific content to specific students.

Technological Pedagogical Knowledge (TPK) comprises the knowledge of how technology can support specific pedagogical strategies in the classroom; for instance, collaborative learning or fostering inquiry.

Teachers require knowledge of the technology itself. Lawless and Pellegrino (2007) asserted that "technological literacy has fast become one of the basic skills of teaching" when teachers train their pupils to be capable technologically, they require the necessary technological skills. They need to participate in continuous professional development, motivation, accessibility to ICT through in-service training and teacher self-learning.

Even though many teachers graduating nowadays are expected to be "digital natives" (have no issue when using different technology instruments), many of teachers in service are, or have been, expected to acquire these technological skills using other means which include attending workshops, peer collaborations, additional courses among others. The application of technology software and hardware is not sufficient to help teachers apply the technology efficiently in the classroom, but it only offers the foundation. Teaching on technology demands that instructors increase their knowledge of pedagogical practices across numerous aspects of the planning, evaluation and implementation processes. For instance, when applying technology as a teaching tool teacher must know how to: develop plans for teaching software to pupils, choose suitable computer applications to meet the teaching demands of the curriculum and the learning demands of their pupils and manage computer software and hardware (Lee & Capraro, 2018).

According to Hew and Brush (2007), technology integration can stop the lack of these technology-related management skills. Similarly, the study done by Lilian and Amollo (2020) found out that a mathematics teacher with pedagogical ability makes a change in learning. They contended that if a mathematics teacher poses limited knowledge of prevailing educational technology, incorporating ICT in teaching is severely compromised. Teachers also need a different understanding of the content they are needed to teach and the pedagogical approaches that assist in student learning to use technology to support meaningful student learning and the particular ways in which technology can support those approaches, a large number of studies have suggested. The level to which meaningful ICT integration occurs in classroom teachings relies on the pedagogical knowledge teachers have to use existing software and endure to adapt and develop new technologies to improve the learning and teaching process.

According to Nolan (2008), preparing teachers to apply technology suitably is an essential task. The integration of technology by teachers demands professional development that emphasizes both pedagogical and conceptual concerns. Teachers should start working in their profession by having consistent knowledge and exemplary models of pedagogy that integrate technology with the content of the curriculum (Lawless & Pellegrino, 2007).

With the current world racing into digital media and information, how mathematical activities are created and delivered has changed (Plantin & Punathambekar, 2019). Conversely, not all of the technology-based packages are used for learning and teaching purposes within schools as they are designed with suitable pedagogical issues in mind (Karsenti et al., 2011). Thus, mathematics teachers should be armed with appropriate pedagogical skills and knowledge to ensure effective technology incorporation. A study by Cennamo et al. (2009), states that to attain technology incorporation that aims student learning, teachers require knowledge that allows them to: Classify the technologies that are required to assist specific curricular objectives; Specify how the tools were applied to assist pupils in demonstrating and meeting those objectives; Choice and apply suitable techniques to redress necessities, resolve issues associated with their professional growth and practice.

According to the study done by (Ojwang, 2012) to investigate ICT preparedness in public secondary schools in Kisumu county Kenya, it was evident from the survey that teachers' readiness to integrate ICT was influenced significantly by ICT infrastructure. The study by Mulwa et al. (2011) concluded that the accessibility to ICT equipment and resources was sufficient to measure teachers' preparedness to incorporate ICT in learning and teaching. Mbabu and Sakwa (2012) suggested a rose in the venture to equip and improve the schools with ICT-literacy training infrastructure and resources for both students and teachers to redress the pedagogical and technical skill preparedness. The availability of ICT resources will leverage the teacher's skills to increase the slow rate of integration and improve the pace of diffusion in primary schools. Instructors have no complete knowledge of tools available as they vary (Kirkok & Karanja, 2018). This study will try to determine if a primary mathematics teacher in public schools of Nakuru East sub-county possesses the necessary technical skills and whether they are trained in preparation for the integration of ICT in their teaching.

2.5 Teacher Characteristics That May Influence Their Use of ICT in Teaching

2.5.1 Teacher's Attitude

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Effectively implementing and initiating educational technology in school programs relies strongly on the teachers' attitude and support. When teachers perceive technology programs as neither satisfying their wants nor their student's wants, it is possible that they will not incorporate the technology into their learning and teaching. The success of pupils learning mathematics with computer technology depends on teachers' attitudes and their preparedness to include computer technology (Kuboja, 2019).

According to Uslu and Bumen (2012), research done in Israel showed that teachers' attitude is critical in finding out whether technology application in education was a success or failure. Those teachers who have a positive disposition concerning technology usually have a high chance to incorporate it into their classroom activities (Kitheka, 2019).

Research studies suggest that teacher's attitudes play a prominent role in education communication and mathematic teaching choices and are fundamental for the successful integration and usefulness of ICT into mathematics teaching (Dogan, 2010). A study conducted by McAlister et al. (2005) observed the attitudes of teachers' towards computers use in teaching mathematics in the primary school classroom revealed that teachers' positive attitudes towards the ICT use in teaching and the accessibility of the essential resources were important determinants to assist in technology use in teaching mathematics in the primary school classroom. It is a belief that teachers' positive attitude concerning ICT is anticipated to improve the integration of ICT in mathematics teaching (Andoh, 2012).

Studies reveal that teachers' attitudes towards technology impact their approval of the helpfulness of technology and its incorporation into teaching (Mulwa et al., 2011). In European Schoolnet's (2010) research on teachers from six European Union nations on the use of Acer netbooks, a higher number of those who took part in the interview were of the view that the use of netbooks had a positive influence on their learning activities by promoting personalized learning and assisted to prolong research beyond the school day. The Empirical research showed that a close to 20% of European teachers thought that the application of ICT in teaching did not assist their pupils' learning (Korte & Hüsing, 2006). A study in the United Kingdom on teachers also showed that teachers' positivity about the likely influences of ICT is regulated. They became 'sometimes doubtful' about 'specific, current advantages and 'rather more ambivalent' (Becta, 2008). Conversely, the suggestion proposes that an insignificant number of teachers think that the importance of ICT is not evident.

Lumumba (2007) asserts that it is not in doubt that teachers' participation helps open prospective gains that ICT learning could provide the students. Still, teachers' positive attitude towards integrating ICT in mathematics teaching will significantly limit the learners' chance of applicability. According to Keengwe and Onchwari (2011), it is not enough to offer Information and Communication Technology education to teachers. It is how the teachers consider it meaningful and how easy it is to use that dictates how teachers integrate and adopt the new technology. This study will try to find out the attitude that primary school teachers possess, whether they favor or disfavor the introduction of ICT/ laptop project. A positive attitude is expected to foster ICT integration in the classroom and influence teacher's acceptance. For successful integration of ICT into the curriculum, teachers should believe technology fulfills both the needs of their students and their needs (Nyambane & Nzuki, 2011).

2.5.2 Teaching Experience

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Though some studies revealed that teachers' experience in teaching did not impact their application of computer technology in education (Giordano, 2007), many survey revealed that teaching experience impacts the successful application of ICT in classrooms (Wong & Lia, 2008). Gorder (2008) asserted that experience in teacher is considerably related to the actual application of technology. In the survey, Gorder showed that the efficient application of computers was correlated to technological comfort levels and the liberty to shape teaching to teacher-perceived student requirement. Also, Baek et al. (2008) asserted that experience in teachers is reluctant to incorporate ICT into their teaching.

Research done in the United States of America by the National Centre for Education Statistics, 2000 asserted that less experienced instructors were highly expected to incorporate ICT during teaching as compared to more experienced teachers. Additionally, Lau and Sim (2008) did a survey on the degree of ICT incorporation among some 250 secondary school teachers in Malaysia. Their results showed that old age instructors regularly incorporate computer technology while in classrooms as compared to their younger counterparts. The main aim could be that the more former teachers have vast experience in classroom teaching, management and also proficient in the application of computers can certainly incorporate ICT into their teaching.

According to the research by Ayub et al. (2015), new teachers were greatly skilled with technology as compared to the teachers who stayed longer in teaching profession who do not integrate Information and Communication Technology in their teaching. But in a research of close to 3000 teachers, showed that the quality of Information and Communication Technology incorporation was correlated to the years of teaching service. Conversely, a research conducted by a qualitative research on issues contributing to teachers' successful application of Information and Communication Technology in Canada. They cross-examined 60 respondents from 12 schools (Granger et al., 2002). The outcomes established that no relationship among teacher's teaching experience in the application of Information and Communication Technology, it means that teachers' Information and Communication Technology skills and successful implementation are complex and not a precise predictor of

ICT incorporation Instructors' computer experience relates positively to their computer attitudes. The more experienced instructors have with computers, the highly expected that they will demonstrate positive attitudes towards integration in the classroom (Van Braak et al., 2004). According to Drossel et al. (2017) for effective changes in educational practice, users require to develop positive attitudes toward the innovation of Computers. Positive computer attitudes are expected to foster computer integration (Ghavifekr & Rosdy., 2015).

2.5.3 _ICT Competence

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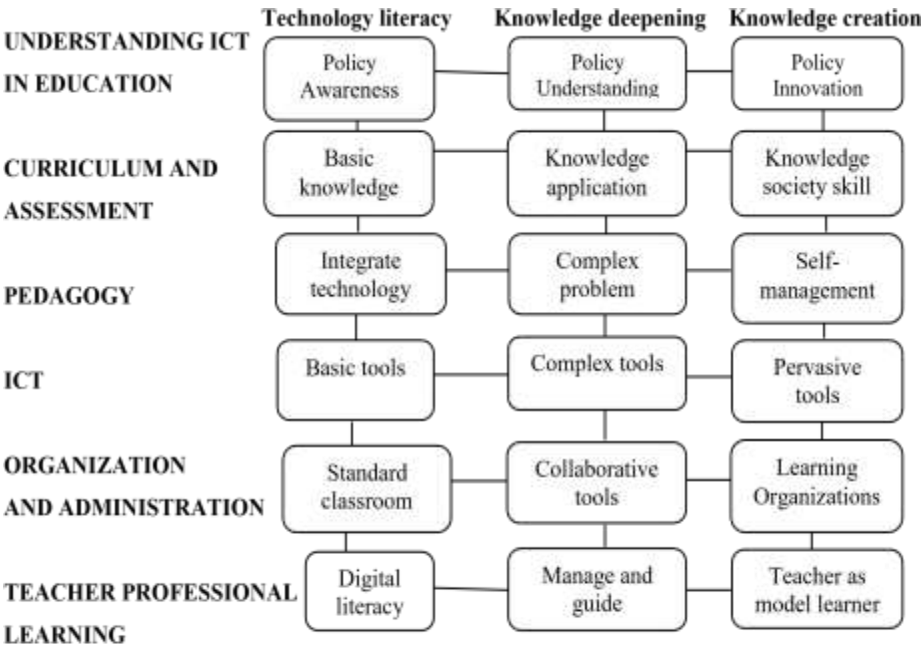

Figure 3: Effective ICT integration-TPACK model

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Source: UNESCO (2011)

For technological Literacy-teachers need professional development program to integrate the use of essential ICT tools into school curriculum pedagogy and classroom structures, and also enable teachers and learners to use ICT to support social development? Teacher's competencies in this approach include necessary digital literacy skills and digital citizenship along with the ability to select and use appropriate off-the-shelf educational tutorials, games, drill-and practice software, and web content with limited classroom facilities to complement standard curriculum objectives assessment approach unit plans and didactic teaching methods.

On knowledge deepening, UNESCO (2009) states that educational changes related to experience an intensifying approach adds value to society and the economy by having learners to apply the wisdom of school subjects to solve complex problems encountered in the real world situations of work and life. Teachers should have professional development that would provide them with the skills to use more sophisticated methodologies & technologies with changes in the curriculum that emphasize the depth of understanding of key concepts and their application of knowledge to complex real-world problems and pedagogy where the teacher serves as a guide and manager of the learning environment. Teachers should be able to use networked and web-based resources to help students collaborate, access information, and communicate with external experts to analyze and solve their selected problems, to support collaborative projects, Teachers should be able to use ICT to create and monitor individual and group students' project plans as well as to access information and experts and collaborate with other teachers.

Knowledge Creation-aims at increasing civic participation, cultural creativity, and economic productivity by developing a population that is continuously engaged in and benefits from knowledge creation innovation and involvement in the learning society. The curriculum goes beyond a focus on knowledge of school subjects to include the 21st-century skills that are needed to create an experience and engage in lifelong learning to collaborate, communicate, create, innovate and think critically. The role of the teacher is to overtly model these processes structure situations in which students apply these skills and assist students in their skill acquisitions. Teachers will build a learning community in the classroom in which students are continuously engaged in developing their learning skills. Teachers were seen as model learners and producers of knowledge who are involved in educational experimentation and innovation in collaboration with their colleagues and outside experts to create new awareness. The teacher should be able to use a variety of networked devices, digital resources, and electronic environments to develop and support learners in their production of knowledge anytime anywhere.

UNESCO competency framework emphasis is that it is not enough for teachers to have ICT competencies and be able to teach them to their students. The success of ICT integration into the classroom depends on the ability of the teachers to structure the learning environment in new ways, merge new technology to develop socially active classes, encouraging cooperative interactions, collaborative learning, and group work. The framework specifies the competencies that teachers will need in each approach used in the six aspects of the teachers' work that includes: understanding ICT in education, curriculum assessment, pedagogy, ICT organization and administration, and teachers' professional learning. By matching the three approaches with the six aspects of teacher's work creates a framework shown in Figure 3.

Successful integration of ICT into mathematics instruction depends on the ability of teachers to structure their learning environment in non-traditional ways, merging technology with new pedagogies; requires a very different set of classroom management skills to be developed together with innovative ways of using technology (Hennessy et al., 2010).
Teachers' computer competence is a significant predictor of integrating ICT in teaching; Evidence suggests that the majority of teachers who reported negative or neutral attitudes towards the integration of ICT into teaching and learning processes lacked knowledge and skills that would allow them to make "informed decisions" (Bordbar, 2010). In a multiple qualitative case-study researched on primary school competence and confidence level regarding the use of ICT in teaching practice conducted in five European countries, it was found that technical competence influenced Italian teacher's use of ICT in teaching(Sáez-López et al., 2016). However, the teachers cited pedagogical and didactic skills as significant factors if effective and efficient educational interventions are likely to be implemented. According to Bukaliya and Mubika (2011), teachers with more experience with computers have greater confidence in their skills and ability to use them effectively.

According to Bukaliya and Mubika (2011), teachers with more experience with computers have greater competence and confidence in their skills to use them successfully. According to Ottenbreit-Leftwich et al. (2018) teacher's expertise is related directly to belief. Teacher's confidence relates to their perceptions of the ability to use computers in the classroom mainly about their children's perceived competence. Bandura's self-efficacy theory states that people would be motivated to act if they are confident that they would accomplish that action successfully (Chen, 2010). Teachers' computer competence influences teachers' decision to integrate technology in their lessons (Khan & Clement, 2012). Teacher's ability in the use of technology is found to correlate with their expertise. It was found to be a predictor for computer use among mathematics teachers (Kamalodeen et al., 2017). Teachers who feel incompetent towards instructional tasks would less likely attempt the task. Teacher's competence can be used to measure teacher's preparedness to teaching with technology (Teo & Russo, 2012). The increase in teacher's ability has the potential to enhance their confidence to make pedagogical changes towards using technology for mathematical instruction.

Drent and Meelissen (2008) carried out a study on factors that influence the innovative use of ICT by teacher educators in the Netherlands. A sample of 210 teachers was used for the study. Their research revealed that a student-oriented pedagogical approach, positive attitude towards computers, computer experience, and personal characteristics of the teacher educator have a direct positive influence on the innovative use of ICT by the teacher.

The success of ICT preparedness of primary mathematics teachers in Kenya for its integration is to ensure that the approach/approaches chosen enable the teachers to acquire a variety of competency standards. The researcher investigated what competencies, primary teachers possess and what has been done to promote ICT competence in preparation for the introduction of the laptop project in Kenyan primary schools.

2.6 Theoretical Framework

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The study is guided by the Davies technological acceptance model (TAM) Davis (1989) and Ajzen's theory of planned behavior (TPB) (Ajzen, 1991). The necessary ground of TAM, as developed by Davies (1989), is to explain computer usage behavior. TAM specifies the causal linkages between two determinants of computer acceptance that is capable of explaining user behavior across a broad range of technologies perceived use (P U) and perceived ease of use (P E U) and user's attitude (A), behavioral intention (B I) and actual computer usage. (Figure, 4)

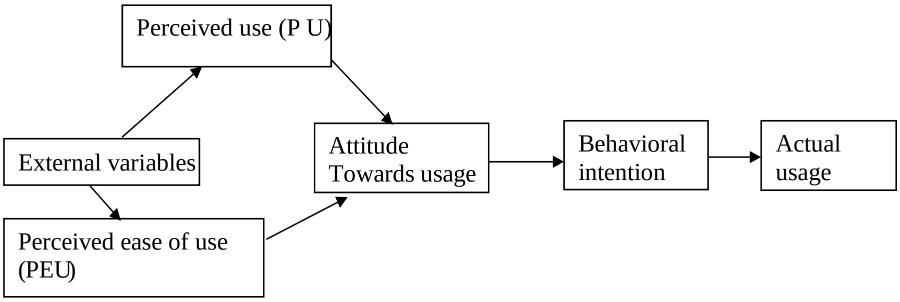

***Figure 4*: Theory of Acceptance Model (TAM)**

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Source: Davis (1989)

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Perceived Use (P U) is the users' subjective probability that using a distinct technology will increase his /her efficiency in an institution (enhance teaching performance). While Perceived Ease of Use (PEU) refers to the level at which the individual expects the intended technology does not demand considerate time and effort (free from exertion), which encourages its successive use for teaching functions. This definition proposes that if a technology is believed as being suitable, a student or a teacher will have a positive attitude towards it which stimulate its successive application in practice. PEU can assist to encourage a teacher's belief on the effectiveness of a technology (Davis, 1989).

Both PU and PEU envisage attitude toward using technology and is also defined as the users focus on the use of technology. In the theory of planned behavior (TPB), model behavior is determined by the rationale to execute behavior. The purpose or the rationale is foreseen by three factors namely: Attitude towards the behavior (A), subjective norms (SN), and perceived behavior control (PBC), as shown in Figure 5.

According to the Davis model, external variables are things that affect the teachers' use of ICT, which come from outside their spheres beyond their control. This includes the requirement of a uniform national curriculum and guidelines, the change in society with rapid growth in 21st century ICT skills, and school policies.

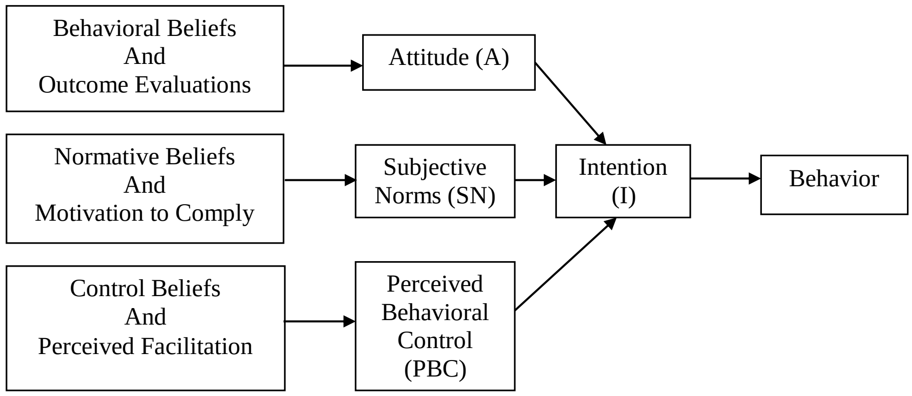

Figure 5: The Theory of Planned Behavior

Source: Ajzen (1991)

The TPB indicate that the behavior of teacher's is being administered by one's behavioral and attitudes purposes described by the exercise of volitional control and the presence of social norms.

Behavioral Beliefs depicts the teacher's behavioral beliefs which serve as the link between behavior that is anticipated to produce or bring about outcome. Normative Beliefs include the characters around the teachers, precisely their behavioral expectations as he perceives them to be. Additionally, it is also shapes the level of importance of teacher's anticipations. Together, these regulate the subjective norm that will play a significant role in teacher's conclusions on whether to act in a particular manner or not.

Control Beliefs refers to perceived control factors, which will command teachers' alleged behavioral control. Each control factor can be regarded individually and teacher's insight of the power of one control factor may be diverse from the power of the other control factors. When there is a higher likelihood that the dominant control factor is existent, the teacher has the probability of carrying out the action in line with the powerful factor.

For TAM model, both Intention (I) and Attitude (A) carry the same meaning. Subjective Norm (SN) is the individual's insight of social pressure to execute the behavior. Perceived Behavior Control (PBC) is the individual's insight of his or her control over the performance

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of the behavior. Beliefs are the precursor to attitude, subjective norms and perceived behavioral control. Perspective is a function of the products of behavioral anticipations and outcome evaluations. A behavioral understanding is a subjective likelihood that the behavior will result to a specific result. The TAM theory, describe using of computer behavior by teachers while the theory of Planned Behavior to envisage teacher preparedness and attitude towards the application of computers software in learning and teaching mathematics teachings.

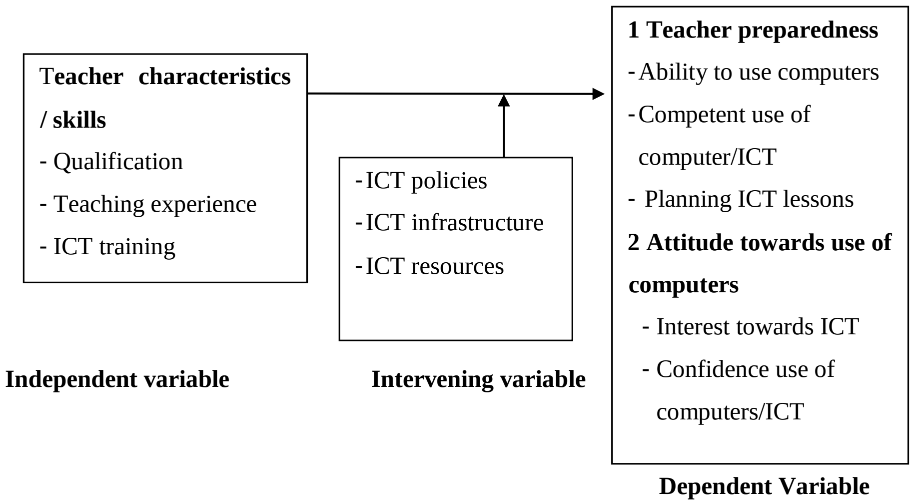

Figure 6: Conceptual Framework showing Relationship between Variables

Figure 6 show that teacher characteristics (Qualification, teaching experience, and ICT training) have a significant direct influence on teacher preparedness and attitude. The qualification, teaching experience and ICT training of the teacher may influence teacher preparedness and attitude towards use of computers in teaching and learning mathematics. The intervening variables (ICT policies, ICT infrastructure, and ICT resources) were presumed to have indirect effect on the relationship between teacher characteristics and teacher preparedness and attitude towards use of computers in teaching and learning mathematics thus the effect intervening variables was not determined in this study. The level of teacher preparedness can be used to appraise the teacher training programs for the purposes of successful ICT integration in mathematics instructions in public primary schools.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

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This chapter is concerned with the description of the processes followed in conducting the research. It gives the summary of the whole research process and includes the research design, location of the study, the study population and its characteristics, sampling procedures, sample size, the instruments used in collecting data, data collecting techniques, data analysis and a short summary of statistical test used in the testing of hypothesis.

3.2 Research Design

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This research used a correlational study design. According to Creswell (2015), a correlational study is a quantitative method of research in which two or more quantitative variables from the same group of participants are studied to determine if there is a relationship between the two variables. This design enabled a researcher to gather a considerable amount of data in a short time (Borg & Gall, 2007).

3.3 Location of the Study

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The study was carried out in Nakuru East Sub-County of Nakuru County. This is one of the eleven sub-counties in Nakuru County; its headquarters is Nakuru town. Situated on latitude 0.303099 longitude 36.080025. Nakuru East Sub-County was suitable for research study since most of the sixty-two public primary schools were suitably equipped with ICT resources.

3.4 Population of the Study

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The population was all teachers in public primary schools in Nakuru East Sub-county of Nakuru County. There are five divisions, with 62 public primary schools, and a total of 1364 teachers. The target population was all public primary school teachers in the sub-county. There is no specialization in teaching primary school subjects. Therefore, all teachers can teach primary school mathematics. Thus, the accessible populations were all public primary school teachers.

Table 1 shows the population of teachers in the five divisions of Nakuru East Sub County per division and gender. There were 1040 females and 324 male teachers in the whole sub county.

Name of division	Teachers population		
	Female	Male	Total
Nakuru Central	157	42	199
Nakuru Eastern	234	89	323
Northern	206	53	259
Southern	196	80	276
Western	247	60	307
Total	1040	324	1364

Source: Sub-County Director of Education Nakuru (2019)

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3.5 Sampling Procedures and Sample Size

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Sampling implies choosing a given number of subjects from a defined population as representative of that population. According to Creswell (2015), any statements made about the sample should also be true of the population. This study adopted purposive sampling e and stratified random sampling to select a sample size of 140 participants from the 1364 mathematics teachers. The researcher used the list of schools at Nakuru East Sub- County director's management office as the sampling frame. The school with well-established ICT policies and resources were purposefully selected. The teachers in any given school were further stratified by gender and qualification and using the attendance register in the head teachers' office as the sampling frame. Participating teachers were purposely selected after stratification based on gender and qualification.

The following formula by Creswell (2015), was used to determinate sample size.

$$n = \frac{NC^2}{C^2+(N-1)e^2}$$

Where: n = Sample size, N = Population, C = Coefficient of variation, e = Standard error.

C=25% is acceptable according to Creswell (2015) e = 0.02 and N=1364

$$n = \frac{1364 \times 0.25^2}{0.25^2 + (1364-1)0.02^2} = \frac{85.25}{0.6077} = 140$$

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Table 2 shows the number of schools in Nakuru East Sub-County per division, the population of teachers, sample size in the division per gender, and the selected sample.

Table 2: Sample Distribution of Teachers per Divisions and Gender

Name of Division	No of schools	Population of teachers	Female Population	Female sample	Male population	Male sample	Selected sample
Nakuru Central	12	199	157	16	42	4	20
Nakuru Eastern	15	323	234	24	89	9	33
Northern	10	259	206	21	53	6	27
Southern	13	276	196	20	80	8	28
Western	12	307	247	26	60	6	32
TOTAL	62	1364	1040	107	324	33	140

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Table 3: Proportionate Distribution of Teachers' Sample Size per Divisions and Gender

Name of Division	Female Population	Formula $\frac{Femp * n}{N}$	Female sample	Male Population	Formula $\frac{Malep * n}{N}$	Male sample	Selected sample
Nakuru Central	157	$\frac{157*20}{199}$	16	42	$\frac{42*20}{199}$	4	20
Nakuru Eastern	234	$\frac{234*33}{323}$	24	89	$\frac{89*33}{323}$	9	33
Northern	206	$\frac{206*27}{259}$	21	53	$\frac{53*27}{259}$	6	27
Southern	196	$\frac{196*28}{276}$	20	80	$\frac{80*28}{276}$	8	28
Western	247	$\frac{247*32}{307}$	26	60	$\frac{60*32}{307}$	6	32
TOTAL	1040		107	324		33	140

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$$\frac{Femp * n}{N}$$

Where Femp = Female population per division

$$\frac{\text{Total population of teachers per divsion X 140}}{\text{Total population of teachers in all divsions}}$$

n=Selected sample obtained by

N=Female population per division

$$\frac{Malep * n}{N}$$

Where Malep=Male population per division

$$\frac{\text{Total population of teachers per divsion X 140}}{\text{Total population of teachers in all divsions}}$$

n=selected sample obtained by

N=Female population per division

3.6 Instrumentation

In this research, data were collected through structured questionnaires which were circulated to the teachers at the place of work. A questionnaire was selected because it offers a higher degree of data standardization and adoption of generalized information amongst any population (Fisher et al., 2016). The questionnaire was presented in two parts. Part I was made of closed-ended questions which gives demographic information of the respondents. The questions sought factual information on teacher characteristics and skills. Part II aimed at exploring the opinions perceptions, and attitudes of the respondents concerning the variables used in the study. A 5 point Likert scale (1=strongly disagree, 2=disagree 3=neutral, 4=agree and 5= strongly agree) was used to solicit respondents' perceptions and opinions regarding the influence of teachers' characteristics on their attitude and preparedness to integrate information communication technology in mathematics instruction in primary schools in Nakuru East sub-county, Kenya.

3.6.1 Validity of Research Instruments

The validity of research involves the interpretation of research results with confidence and generalizability of the results (Orodho, 2009). For something to be valid, it has to be based on facts or evidence that was capable of being justified on expert review and judgment. To ensure the validity of the instruments to be used in this study, the researcher gave them to

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experts in the department of Curriculum Instruction and Education Management (CIEM) of Egerton University main campus. The supervisors assisted in enhancing the face and content validity of the instrument.

3.6.2 Reliability of Research Instruments

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Reliability is concerned with the replicability of both procedures and findings. According to Orodho (2009) reliability of a tool is the consistency in generating a reliable outcome at different times. The tool was pilot- tested on teachers from Njoro Sub-county, to ascertain their reliability.

The Cronbach Alpha reliability coefficient for the questionnaire was found to be 0.906, as shown in Table 4 which according to Gamble (2018), was above the threshold of 0.7 and hence is considered excellent. This shows that the research tool was a reliable measure for this research.

Table 4: Reliability Statistics

	Cronbach's Alpha	No of Items
Overall reliability	0.906	33
Reliability Per Variable		
Teacher characteristics	0.923	14
Preparedness to integrate ICT in mathematics teaching	0.907	5
Attitude towards the integration of ICT in mathematics teaching	0.803	8

3.7 Data Collection Procedures

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Before data collection, the researcher applied for research permit from the National Council for Science and Technology (NACOSTI). The graduate school wrote an introductory letter to NACOSTI so that that the researcher could get clearance to carry out the research. The researcher also notified the Deputy County Director of Education in advance. Afterward a pretest was conducted by the researcher where she visited the selected primary schools and administered the questionnaires to the teachers. The researcher explained the purpose of the research to the teachers. The researcher explained the purpose of the research to the respondents and gave further guidelines on how to fill the questionnaire. The researcher further explains to the participants that the information given will be treated with confidentiality and data obtain will be used for research only.

3.8 Data Analysis

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The data collected were analyzed using both inferential and descriptive statistics. Descriptive statistics, percentages frequencies, means and standard deviation (SD) were generated to explain various attributes of the variables under study. Besides, the researcher used the Pearson correlation coefficient and multiple regression analysis to determine the relationship among teacher characteristics/skills, teacher preparedness and attitude towards the use of computers, respectively. The hypothesis was tested at the 0.05 Alpha (α) level. The data were analyzed using a computer-aided program, the Statistical Package for Social Science (SPSS) version 26.

3.8.1 Regression Model Equation

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The following multiple linear regression function was used for this study:

$$Y = B0 + \beta 1X1\ (TE) + \beta 2X2\ (TQ) + \beta 3X3\ (ICT) + \varepsilon \quad 3.1$$

Where Y = Teachers attitudes and preparedness to integrate ICT in primary school mathematics instruction B_0 = Constant

β_1 - β_3 = Regression coefficients

X_1 = Qualification

X_2 = Teachers

experience X_3 = ICT

training

ε = Error term

Objective 1

$$Yi = B0 + \beta 1X1\ (TE) + \beta 2X2\ (TQ) + \beta 3X3\ (ICT) + \varepsilon \quad 3.2$$

Yi = Teachers attitude towards the integration of ICT in mathematics instruction

B_0 = Constant

X_1 = Teachers experience;

X_2 =Qualification

X_3 = ICT training

ε = Error term

Objective 2

$$Yii = B0 + \beta1X1\ (TE) + \beta2X2\ (TQ) + \beta3X3\ (ICT) + \varepsilon \quad 3.3$$

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Y_i = Teachers preparedness to integrate ICT in mathematics instruction.

B_0 = Constant

X_1 = Teachers experience;

X_2 =Qualification

X_3 = ICT training

ε = Error term

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CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents the results and discussions. The chapter presents demographic information of the respondents, results of data analysis grounded on the objectives of the research. Data were performed and analyzed using inferential and descriptive statistics. The descriptive statistics include percentages, frequencies, means and standard deviation, while inferential statistics include Pearson correlation and linear regression.

4.2 Questionnaire Return Rate

The research targeted one hundred and forty (140) primary school mathematics teachers in Nakuru East Sub- County. One hundred and Thirty-eight (138) questionnaires out of the 140 distributed were filled and returned giving a response rate of 98.6%. This response rate is an excellent representative and conforms to (Mugenda and Mugenda, 2003) stipulation that a response rate of 50% and above is adequate for analysis and reporting; a rate of 60% is reasonable while a response rate of 70% and over is excellent.

4.3 Demographic Data of the Respondents

The research analyzed the demographic information of the respondents, which comprised gender, age, the highest level of education, years of teaching experience, trained in the use of ICT in teaching and learning, and school location. Descriptive statistics in the form of percentages and frequencies were used to analyze the information and presented in the form of tables. Table 5 shows participants of the primary school teachers by gender.

Table 5: Participants of the Primary School Teachers by Gender

		Frequency	Percent
Gender	Male	56	40.0
	Female	84	60.0
	Total	140	100.0

Based on the results in Table 5, the study established that the majority of the respondents were female (60%) compared to 40% men. This indicates that females were the majority of mathematics teachers in primary schools in Nakuru East Sub-County. The results of the study in Table 5 are in tandem with the results of the study done by Kahn and Ginther (2017) on women and STEM where the results of their study established that more women are pursuing STEM subjects compared to men. Table 6 shows the participants' highest level of education.

Table 6: Level of Education

		Frequency	Percent
Highest level of education	M.Ed	6	4.3
	B.Ed	51	36.4
	Diploma	49	35.0
	Certificate	34	24.3
	Total	140	100.0

Grounded on the results of the study in table6 shows that the participants highest level of education, 36.4% of the respondents were Bachelors of Education Degree, 35.0% diploma holders, 24.3% certificate holders and 4.3% Master's Education degree respectively. It indicates that majority of mathematics teachers in primary schools in Nakuru East Sub-County have attained Bachelor of Education Degree as the highest level of education, which could attribute to the high number of universities offering school-based Bachelor of Education degree courses. The findings' showed that all respondents have attained good level of education. Table 7 shows the years of teaching experience.

Table 7: Teaching Experience

		Frequency	Percent
Years of teaching	Less than five years	11	7.9
experience	6-10 years	42	30.0
	11-15 years	32	22.9
	16-20 years	14	10.0
	Above 20 years	41	29.3
	Total	140	100.0

In terms of years of teaching experience, the results of the study in Table 7 specify that only 30.0% of the respondents had worked for 6-10 years, 29.3% above 20 years, 22.9% 11-15 years, 10% 16-20 years and 7.9% had worked for less than five years. Findings show that majority of the respondents have worked for a long period so they have a lot of experience in teaching and learning mathematics. Table 8 shows the participants trained in the use of ICT in teaching and learning mathematics instructions.

Table 8: Trained in the use of ICT in Teaching and Learning

		Frequency	Percent
Trained in the use of ICT in teaching and learning	Yes	99	70.7
	No	41	29.3
	Total	140	100.0

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In terms of the training on the use of ICT in Teaching and Learning, the results of the study in Table 8 indicates that 70.7% of mathematics teachers in primary schools in Nakuru East Sub-County are trained on the use of ICT in Teaching and Learning compared to 29.3% untrained on the use of ICT in Teaching and Learning trained. It implies that the Government of Kenya, through the ministry of education, has trained most of primary school's mathematics teachers on the use of ICT in Teaching and Learning.

Table 9: School Location

		Frequency	Percent
School location	Urban	117	83.6
	Rural	23	16.4
	Total	140	100.0

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In terms of school location, the results of the study in Table 9 indicate that 83.6% of primary schools in Nakuru East Sub-County located in urban areas compared to 16.4% found in rural areas. This means that the majority of primary schools in Nakuru East Sub-County are located in urban areas.

4.4 Normality Tests of the Variables of the Study

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The researcher conducted normality tests on the three variables namely; Teacher characteristics, teacher's attitudes towards the integration of ICT in mathematics instruction, and teacher's preparedness to integrate ICT in mathematics instruction variables, and their results are shown in Figures 7, 8, and 9.

Figure 7 shows the normal histogram plot of teacher's characteristics.

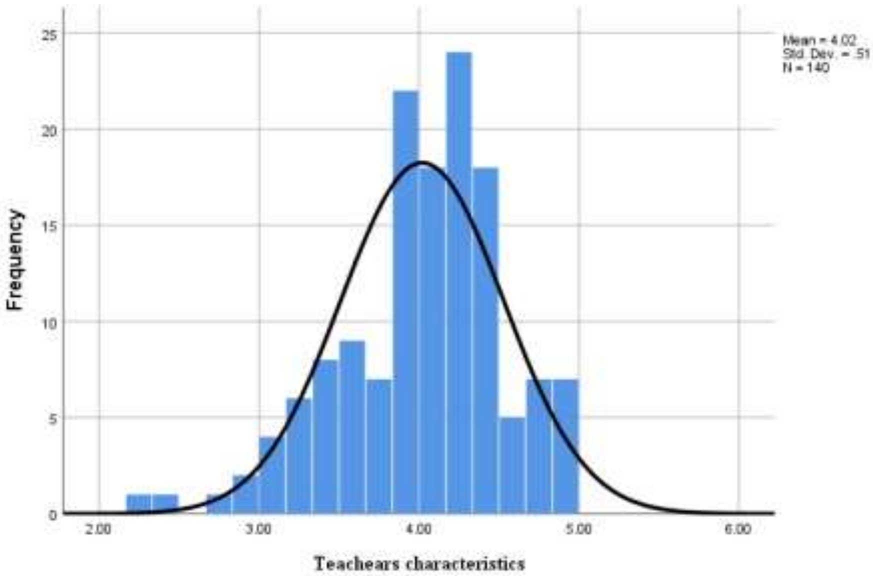

Figure 7: Normal histogram plot of teacher's characteristics

Based on Figure 7, the output of a standard histogram plot showing the teacher's characteristics shows that the data was normally distributed as compared to Shapiro– Wilk test of normality. According to Das and Imon (2016) bell shape curve shows normal distribution and its gives idea of skewness. In addition, Figure 7 indicates that data on teacher's characteristics was not skewed.

Figure 8 shows the normal histogram plot of the teacher's attitude towards the integration of ICT in mathematics teaching

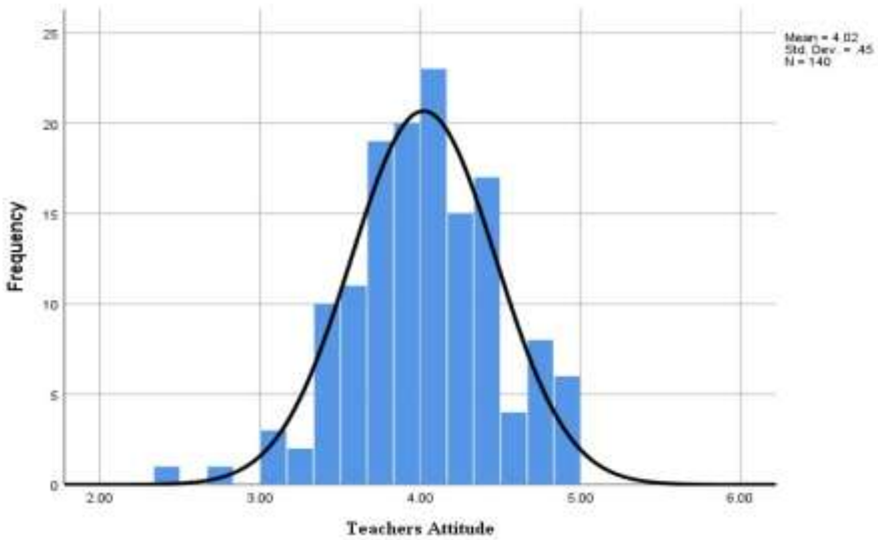

Figure 8: Normal histogram plot of the teacher's attitude towards the integration of ICT in mathematics instruction

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Based on figure 8, the output of a standard histogram plot of teacher's attitude towards the integration of ICT in mathematics teaching shows that the data of teacher's attitudes towards the integration of ICT in mathematics teaching has a normal distribution based on Shapiro–Wilk test of normality. In addition, Figure 8 indicate that the data on teacher's attitude was not skewed.

Figure 9 shows the normal histogram plot of teacher's preparedness to integrate ICT in mathematics instruction.

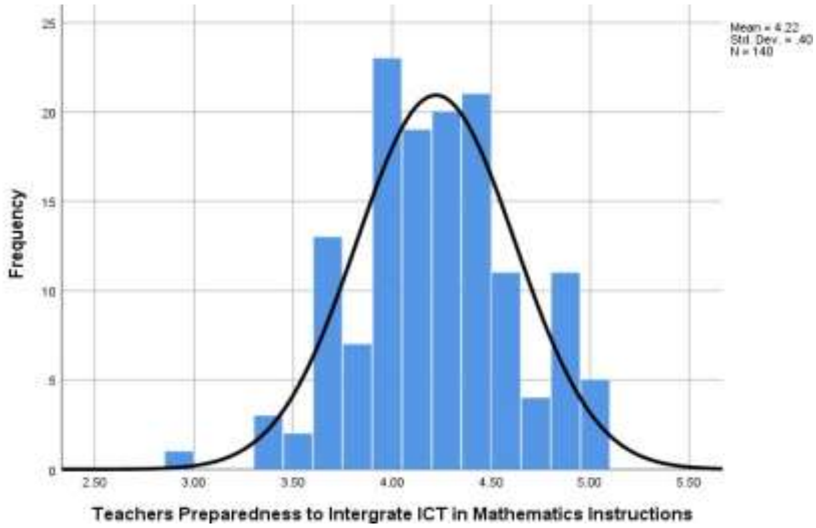

Figure 9: Normal histogram plot of a teacher's preparedness to integrate ICT in mathematics teaching

Based on Figure 9, the output of a standard histogram plot of teacher's preparedness to integrate ICT in mathematics teaching shows that the data of teacher's readiness to integrate ICT in mathematics teaching was normally distributed grounded on Shapiro–Wilk test of normality. Additionally, Figure 9 indicate that the data on preparedness to integrate ICT in mathematics teaching was not skewed.

4.5 Descriptive Statistics

For analysis of elements of teacher characteristics (Teachers qualification, teachers experience and teacher's ICT training in the use of computers in teaching and learning), attitude towards the integration of ICT in mathematics teaching, and teacher's preparedness to integrate ICT in mathematics teaching descriptive statistical analysis was used.

4.5.1 Descriptive Statistics of Teacher Characteristics

Elements of teacher Characteristics was analyzed using descriptive statistical analysis. Likert scale (reference scale) was used in the research design, five indicated frequently, four served occasionally, three represented sometimes, two represented rarely, and one described never, therefore never (1) was minimum (Min), often (5) was maximum (Max) (Willits et al.,

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2016). Table 10 shows the mean scores of the elements of Teacher's qualification to computer software in teaching and learning mathematics.

Table 10: Elements of Teachers Qualification on Use of Computer Software in Teaching and Learning

Elements of Teachers Qualification	N	Min	Max	Mean	SD
Word processor e.g. Ms. Word	140	1	5	3.06	1.274
Data bases e.g. Ms. Access	140	1	5	2.84	1.227
Spreadsheet e.g. excel	140	1	5	2.99	1.217
Presentation Software, e.g., prepare drawings, create a presentation, edit and save	140	1	5	2.76	1.185
Internet e.g. set internet	140	1	5	3.29	1.306
e-mailing e.g. create email, identify and open a mailbox	140	1	5	3.19	1.290

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According to the outcomes of the research in Table 10, most elements had their mean scores approximately 3 (sometimes) showing that most respondents had responses inclined to sometimes in most the aspects of teacher's qualification to Computer Software in Learning and teaching. This could be accredited to the strategies used by the ministry of education to train teachers on the application of computer software in teaching and Learning. Table 11 shows the mean scores of the elements of Teacher's experience in application of computers in learning and teaching mathematics.

Table 11: Elements of Teachers experience in use of ICT in Teaching and Learning Mathematics

	N	Min	Max	Mean	SD
I use a computer for learning or practicing skills	140	1	5	2.55	1.048
Use computer as a tool	140	1	5	2.79	1.128
Use to prepare lessons	140	1	5	2.51	1.178
To communicate with colleagues	140	1	5	3.05	1.140
To process text	140	1	5	2.81	1.092

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According to the mean scores of the elements of Teacher's experience in application of computers in learning and teaching mathematics in Table 11, most elements had their mean score approximately 3 (sometimes) showing that most teachers had responses inclined to sometimes in most the aspects of teacher's experience in use of computers in learning and teaching. This could be accredited to the teachers' lack of experience in the use of computer software in teaching and Learning augmented by the study done by Wanjala (2016) on Information Communication Technology Pedagogical integration in mathematics instruction among teachers in secondary schools in Kenya where the results of the study established that teachers lack of experience in the use of computer software in teaching and Learning.

4.5.2 Descriptive Statistics of Teachers Preparedness to Use Computers

For analysis of the elements of mathematics teacher's preparedness to use computers in teaching and learning descriptive statistical analysis was used. Likert scale (Reference scaling) was used in the research design, 5 indicated very well prepared, 4 represented prepared, 3 indicated moderately prepared, 2 denoted not well prepared, and 1 represented not prepared, therefore not prepared (1) was minimum (Min), very well prepared (5) was maximum (Max).

Table 12 shows the mean scores of elements of teacher preparedness in use of computers in teaching and learning mathematics.

Table 12: Elements of Teacher preparedness in use of Computers in Teaching and Learning Mathematics

Elements of Teacher preparedness	N	Min	Max	Mean	SD
Use computers to demonstrate mathematics principles	140	1	5	2.67	1.214
Use computers for mathematics learning games	140	1	5	2.74	1.209
Use computers to collect and analyses data	140	1	5	2.89	1.204
Use the internet for general references in mathematics	140	1	5	2.96	1.187
Use the internet for data acquisition in mathematics teaching.	140	1	5	2.88	1.226

According to the results of the research in Table 12, many elements had their mean scores around 3 (sometimes). This indicates that most of the mathematics teachers were moderately prepared to use computers in learning and teaching methods. The results of the study conform to the results of the research conducted by Aslan and Zhu (2016) on influencing factors and integration of ICT into teaching practices of pre-service and starting teachers where they established that most of the mathematics teachers were moderately prepared to use computers in teaching and learning.

4.5.3 Descriptive Statistics of Attitude towards Use of Computers

For analysis of elements of attitude towards the use of computers the descriptive statistical analysis was used. Likert scale (Reference scaling) was used in the research design, five indicated strongly agree, four indicated agree, three described neutrals, two indicated disagree and one denoted strongly disagree, therefore strongly disagree (1) was minimum (Min), strongly agree (5) was maximum (Max).

Table 13 shows the mean scores of elements of attitude towards the Use of Computers in teaching and learning mathematics.

Table 13: Elements of Attitude towards the Use of Computers in Teaching and Learning Mathematics

Elements of Attitude	N	Min	Max	Mean	SD
I feel confident that I can choose appropriate software in my mathematics lessons	140	1	5	3.20	1.026
I feel confident that I can use the internet in my lessons to meet specific learning goals	140	1	5	3.63	.884
I feel confident that I can use presentation software in my class	140	1	5	3.35	.974
I feel that I will not master advanced ICT skills.	140	1	5	2.59	1.187
I sometimes get nervous just thinking about ICT	140	1	5	2.51	1.160
Teachers lack in-service training	140	1	5	3.84	1.015
Teachers lack basic knowledge / skills for ICT integration	140	1	5	3.65	1.079
A computer is an available tool for teachers	140	1	5	3.43	1.259

According to the outcomes of the research in Table 13, the respondents agreed that they feel confident when using internet in their lessons to meet specific learning goals, teacher's lack in-service training and necessary knowledge/skills for ICT integration in teaching and learning with mean scores inclined towards 4 (Agree). This agree with the study done by Adukaite et al. (2017) on teacher opinion on the application of digital gamified learning in tourism education where the results of their study reveal that teachers projected confidence when using internet in their lessons to meet specific learning objectives. Moreover, the respondents were neutral that they feel confident to select appropriate software in their mathematics lessons, use presentation software in their classes, will not master advanced ICT skills, and sometimes get nervous just thinking about ICT with mean scores inclined towards 3 (Neutral).

4.6 Influence of Teacher Characteristics on Their Attitude towards Integration of ICT in Mathematics Teaching

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The first objective of the research was to establish the influence of teacher characteristics on their attitude towards the integration of ICT in mathematics instruction. The study used Pearson moment correlation coefficient, Spearman's rank correlation coefficient and multiple regression analysis to analyze the impact of teacher characteristics on their attitude towards the integration of ICT in Mathematics teaching.

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4.6.1 Correlation of Teacher Characteristics and Attitude towards Integration of ICT in Mathematics Instruction

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The first hypothesis of this research stated that there is no significant statistical influence of instructors' characteristics on their attitude towards the integration of ICT in mathematics teaching. The study used Pearson moment correlation and Spearman's rank correlation coefficient to find out the direction, strength, and significance of the correlation that exists among teacher characteristics and attitude towards the integration of ICT in mathematics teaching. Table 14 shows the correlation between teacher's characteristics and attitude towards integration of ICT in mathematics teaching.

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Table 14: Correlation between Teacher Characteristics and Attitude towards Integration of ICT in Mathematics Teachings

		Teachers Attitude
Teaching experience	Pearson Correlation	.687**
	Sig. (2-tailed)	.000
	N	140
Qualification	Spearman's rank correlation	.750**
	Sig. (2-tailed)	.000
	N	140
ICT training	Spearman's rank correlation	.759**
	Sig. (2-tailed)	.000
	N	140
Teachers Characteristics	Pearson Correlation	.879**
	Sig. (2-tailed)	.000
	N	140

** Correlation is significant at the 0.05 level (2-tailed).

Based on Table 14, the results of the study revealed that there was a strong statistically significant positive correlation (r = 0.687, $p < 0.05$, r = 0.750, $p < 0.05$ and r = 0.759, $p < 0.05$) between teaching experience, qualification, ICT training and attitude towards integration of ICT in mathematics respectively. Moreover, the study further revealed the overall existence of a strong statistically significant positive relationship (r = 0.879, $p < 0.05$) between teacher characteristics and attitude towards the Integration of ICT in Mathematics Teaching. Therefore, this confirms the positive impact of teacher characteristics on attitude towards the Integration of ICT in Mathematics Teaching. The results of the study in Table 17 conform with the findings of study done by Chemwei et al. (2016) on relationship between teacher educators' attitude towards computers and their level of ICT integration in instruction in primary teacher training colleges in Kenya where they established that teacher educators' characteristics significantly influence the attitude towards computers and their level of ICT integration in teaching in Kenya.

4.6.2 Regression Analysis

The research additionally used linear regression analysis to find out the impact of teacher characteristics on their attitude towards the integration of ICT in mathematics teaching.

Multiple Regression Model

$$Y_i = B_0 + \beta_1 X_1 (TE) + \beta_2 X_2 (TQ) + \beta_3 X_3 (ICT) + \varepsilon \qquad 4.1$$

Y_i = Teachers attitude towards integration of ICT in mathematics teaching

B_0 = Constant

X_1 = Teachers experience;

X_2 =Qualification

X_3 = ICT training

ε = Error term

Table 15 shows the results of linear regression analysis determining the influence of teacher characteristics on their attitude towards integration of ICT in mathematics teaching.

Results of Linear Regression Analysis Determining the Influence of Teacher Characteristics on Their Attitude towards Integration of ICT in Mathematics Teaching

Table 15: Model Summary

Model	R	R Square	Adjusted R Square	Std. an error of the Estimate	Durbin-Watson
1	.893a	.797	.793	.20486	1.523

a. Predictors: (Constant), ICT training, Teaching experience, Qualification

b. Dependent Variable: Teachers attitude

According to the regression results in Table 15, the linear regression model specifies that teacher characteristics (Teaching experience, qualification, and ICT training) accounted for 79.7% (R^2 = 0. 797) of teacher attitude towards the integration of ICT in mathematics teaching. Therefore 20.3% of the variance in teacher attitude towards the integration of ICT in mathematics teaching was explained by other factors, not in the study.

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Table 16: ANOVA analysis

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	22.476	3	7.492	178.524	.000b
	Residual	5.707	136	.042		
	Total	28.184	139			

a. Dependent Variable: Teachers attitude

b. Predictors: (Constant), ICT training, Teaching experience, Qualification

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The F statistic (178.524) shows the fitness of the linear regression using ANOVA for regression model, which means teacher characteristics is a significant predictor of teacher attitude towards the integration of ICT in mathematics teaching.

Table 17: Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for B		Collinearity Statistics	
	B	Std. Error	Beta	T	Sig.	Lower Bound	Upper Bound	Tolerance	VIF
1 (Constant)	.544	.184		2.963	.004	.181	.907		
Teaching experience	.155	.036	.215	4.264	.000	.083	.228	.586	1.706
Qualification	.247	.031	.423	7.961	.000	.186	.308	.528	1.893
ICT training	.465	.057	.407	8.192	.000	.352	.577	.603	1.657

a. Dependent Variable: Teachers attitude

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The unstandardized beta coefficients indicate that teaching experience, qualification and ICT training (β = 0.155, $p < 0.05$, β = 0.247, $p < 0.05$ and β= 0.465, $p < 0.05$) correspondingly were a strong predictors of teacher attitude towards integration of ICT in mathematics teaching. Consequently, the linear regression outcomes in Table 17 shows that teacher characteristics (Teaching experience, qualification, and ICT training) have a statistical positive significant influence on teacher attitude towards the integration of ICT in mathematics teaching.

Therefore, the null hypothesis (H0=0) which indicated that ‘there is no statistically significant influence of teachers’ characteristics on their attitude towards integration of ICT in mathematics teaching’ was rejected, and the alternative hypothesis ($H1 \neq 0$) which states that ‘there was statistically significant influence of teachers’ characteristics on their attitude towards integration of ICT in mathematics teaching was accepted. This suggests that teacher’s attitude towards the integration of ICT in mathematics instruction is enhanced by teacher characteristics. The outcomes of the research concur with study conducted by Hooker (2017) on the implementation of the" Strengthening Innovation and Practice in Secondary Education Initiative" for the Preparation of Science, Technology, Engineering and Mathematics (STEM) Teachers in Kenya to Integrate Information and Communication Technology (ICT) in Teaching and Learning. The findings of the study also agree with the findings of study done by Marbán and Mulenga (2019) on pre-service primary teachers’ teaching styles and attitudes towards the use of technology in mathematics classrooms where they established that teacher’s attitude had significantly influence the use of technology in mathematics classrooms. From Table 17, the Durbin-Watson statistic is 1.523 which is between 1.5 and 2.5 and therefore the data is not auto correlated (Chang et al. 2019). Moreover, Table 17 indicates that there was no multi-collinearity identified by correlation matrix as shown by tolerance ($T>0.2$) and Variance Inflation Factor ($VIF<10$) and confirmed by condition index and variance proportion (Senaviratna & Cooray, 2019).

Multiple Regression Model

$$Y_i = 544 + 0.155(TE) + 0.247(TQ) + 0.465(ICT) + \varepsilon \qquad 4.2$$

Interpretation

When there is a unit increase in teaching experience, qualification, and ICT training, teacher attitude towards the integration of ICT in mathematics teaching will increase by 0.155, 0.27 and 0.465 units respectively. The linear regression model specifies that the teacher characteristics have a positive influence on teacher attitude towards the integration of ICT in mathematics teaching.

4.7 Influence of teacher characteristics on their preparedness to integrate ICT in mathematics instruction

The second objective of the research study was to establish the influence of teacher characteristics on their preparedness to integrate ICT in mathematics teaching. The study

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used Pearson moment correlation coefficient, Spearman's rank correlation coefficient and multiple regression analysis to analyze the influence of teacher characteristics on their preparedness to integrate ICT in mathematics instruction.

4.7.1 Correlation of Teacher Characteristics and Their Preparedness to Integrate ICT in Mathematics Instruction

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The second hypothesis of this study stated that there is no statistically significant influence of teachers' characteristics on their preparedness to integrate ICT in mathematics teaching. The study used Pearson moment correlation and Spearman's rank correlation coefficient to find out the direction, strength and significance of the relationship that exists among teacher characteristics and teacher preparedness to integrate ICT in mathematics teaching.

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Table 18 shows the correlation between teacher characteristics and their preparedness to integrate ICT in mathematics teaching.

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Table 18: Correlation between Teacher Characteristics and Their Preparedness to Integrate ICT in Mathematics Instruction

		Teachers preparedness to integrate mathematics teaching
Teaching experience	Pearson Correlation	.549**
	Sig. (2-tailed)	.000
	N	140
Qualification	Spearman's rank correlation	.516**
	Sig. (2-tailed)	.000
	N	140
ICT training	Spearman's rank correlation	.580**
	Sig. (2-tailed)	.000
	N	140
Teachers characteristics	Pearson Correlation	.634**
	Sig. (2-tailed)	.000
	N	140

** Correlation is significant at the 0.05 level (2-tailed).

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Based on Table 18, the results of the study showed that there was a moderate statistically significant positive correlation ($r = 0.549$, $p < 0.05$, $r = 0.516$, $p < 0.05$ and $r = 0.580$, $p < 0.05$) between teaching experience, qualification, ICT training and teacher preparedness to integrate ICT in mathematics teaching respectively. Furthermore, the study revealed the existence of a strong statistically significant positive relationship ($r = 0.634$, $p < 0.05$) between teacher characteristics and teacher preparedness to integrate ICT in mathematics instruction. Therefore, this confirms the positive influence of teacher characteristics on teacher preparedness to integrate ICT in mathematics teaching. The results of the study in Table 18 agrees with the findings of the study done by Kafu (2019) on integration of Information Communication and Technology (ICT) in education in modern Africa established that teachers' qualification, ICT training and teaching experience has as a positive effect on ICT integration in teaching and learning.

4.7.2 Regression Analysis

The study additionally used linear regression analysis to find out the influence of teacher characteristics on teacher preparedness to integrate ICT in mathematics teaching.

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Multiple Regression Model

$$Y_{ii} = B0 + \beta_1 X1\ (TE) + \beta_2 X2\ (TQ) + \beta_3 X3\ (ICT) + \varepsilon \qquad 4.3$$

Y_{ii} = Teachers preparedness to integrate ICT in mathematics instruction.

B0 = Constant

X1 = Teachers experience;

X2 =Qualification

X3 = ICT training

ε = Error term

Table 19 shows the results of linear regression analysis determining the influence of teacher characteristics on teacher preparedness to integrate ICT in mathematics instruction

Results of Linear Regression Analysis Determining the Influence of Teacher Characteristics on Teacher Preparedness to Integrate ICT in Mathematics Instruction

Table 19: Model Summary

Model	R	R Square	Adjusted R Square	Std. An error of the Estimate	Durbin-Watson
1	.636a	.405	.392	.31202	1.940

a. Predictors: (Constant), ICT training, Teaching experience, Qualification

b. Dependent Variable: Teacher preparedness to integrate ICT in mathematics teaching

According to the regression outcomes in Table 19, the linear regression model indicates that teacher characteristics (Teaching experience, qualification, and ICT training) accounted for 40.5% (R^2 = 0. 405) of Teacher preparedness to integrate ICT in mathematics teaching. Therefore, 59.5% of the variance in teacher preparedness to integrate ICT in mathematics teaching was described by other influences, which are not included in the research.

Table 20: ANOVA Analysis

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	9.014	3	3.005	30.863	.000b
	Residual	13.241	136	.097		
	Total	22.255	139			

a. Dependent Variable: Teacher preparedness to integrate ICT in mathematics teaching

b. Predictors: (Constant), ICT training, Teaching experience, Qualification

The ANOVA F statistic (30.863) indicated the fitness of the linear regression, which implies that the teacher characteristics are a significant predictor of teacher preparedness to integrate ICT in mathematics teaching.

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Table 21: Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for B		Collinearity Statistics	
	B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound	Tolerance	VIF
1 (Constant)	2.078	.280		7.432	.000	1.525	2.631		
Teaching experience	.180	.056	.280	3.237	.002	.070	.289	.586	1.706
Qualification	.132	.047	.253	2.785	.006	.038	.225	.528	1.893
ICT training	.220	.086	.217	2.547	.012	.049	.391	.603	1.657

a. Dependent Variable: Teacher preparedness to integrate ICT in mathematics teaching

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The unstandardized beta coefficients indicate that teaching experience, qualification and ICT training (β = 0.180, $p < 0.05$, β = 0.132, $p < 0.05$ and β = 0.220, $p < 0.05$) correspondingly were a significant predictors of teacher preparedness to integrate ICT in mathematics teaching. Consequently, the linear regression outcomes in Table 21 indicate that teacher characteristics (Teaching experience, qualification, and ICT training) have a statistical positive significant influence on teacher preparedness to integrate ICT in mathematics instruction. Consequently, the null hypothesis (H0=0) which stated that 'there is no statistically significant influence of teachers' characteristics on their preparedness to integrate ICT in mathematics instruction' was rejected, and the alternative hypothesis (H1≠ 0) which states that 'there was statistically significant influence of teachers' characteristics on their preparedness to integrate ICT in mathematics instruction was accepted. This suggests that teacher characteristics enhance teacher preparedness to integrate ICT in mathematics teaching. The outcomes of the research agree with the findings of study done by Wambiri and Ndani (2016) on Kenya's primary school teachers' preparation in ICT teaching: teacher beliefs, attitudes, self-efficacy, computer competence and age where the findings of her study established that provision of computers and other infrastructure in schools will not automatically lead to integration of ICT in primary schools unless the government addresses the influence teachers' characteristics to enhance integration of ICT in schools. From Table 21, the Durbin-Watson statistic is 1.940 which is between 1.5 and 2.5 and therefore the data is not auto-correlated (Jin et al., 2018). Moreover, Table 21 indicates that there was no multicollinearity as shown by tolerance ($T>0.2$) and Variance Inflation Factor ($VIF<10$) (Marcoulides & Raykov, 2019).

Multiple Regression Model

$$Y_i = 2.078 + 0.180(TE) + 0.132(TQ) + 0.220(ICT) + \varepsilon \quad 4.4$$

Interpretation

When there is a unit increase in teaching experience, qualification, and ICT training, teacher preparedness to integrate ICT in mathematics teaching will increase by 0.180, 0.132 and 0.220 units, respectively. The linear regression model stipulates that the teacher characteristics have a positive statistical influence on teacher preparedness to integrate ICT in mathematics teaching.

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CHAPTER FIVE

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the outline of the research findings, conclusion and recommendations based on the results of the research.

5.2 Summary of the Study Findings

The purpose of the research was to determine the influence of public primary school teachers' characteristics on their attitude and preparedness to integrate ICT in mathematics teaching in Nakuru East sub-county, Kenya. The analysis of the research data provided insight into key findings on influence of teaching experience, qualification, and ICT training on teacher attitude and preparedness to integrate ICT in mathematics teaching in Nakuru East sub-county, Kenya. Specifically, the outcomes of the research revealed that; Teaching experience, qualification, and ICT training were significant determinants of attitude and preparedness to integrate ICT in mathematics instruction in Nakuru East sub-county, Kenya. The outcomes were summarized as per the research objectives.

5.2.1 Teacher Characteristics and Their Attitude towards Integration of ICT in Mathematics Instruction

The first objective of the research was to find out the influence of teacher characteristics on their attitude towards the integration of ICT in mathematics teaching. Based on the findings of the study, it was determined that grounded on teaching experience, qualification and ICT training, mathematics teachers sometimes use computers to demonstrate mathematics principles band mathematics learning games. In a wider range, the outcomes showed a strong statistically positive correlation among teacher characteristics and their attitude towards the integration of ICT in mathematics teaching, specified by a strong positive considerable correlation of $r = 0.879$, $p < 0.05$. Therefore, this confirms the positive influence of teacher characteristics on attitude towards the Integration of ICT in Mathematics Teaching.

5.2.2 Teacher Characteristics and Their Preparedness to Integrate ICT in Mathematics Instruction

The second objective of the research was to find out the influence of teacher characteristics on their preparedness to integrate ICT in mathematics teaching. Grounded in the findings of the research, it was found that despite teaching experience, qualification, and ICT training, mathematics teachers agreed that they lack in-service training and necessary knowledge/skills for ICT integration and use the internet in their lessons to meet specific learning goals. In wider range the outcomes showed a strong statistically positive correlation among teacher characteristics and their preparedness to integrate ICT in mathematics teaching, specified by a strong positive considerable correlation of r = 0.634, $p < 0.05$. Therefore, this confirms the positive influence of teacher characteristics on teachers' preparedness towards the Integration of ICT in mathematics teaching.

5.3 Conclusions

Based on the outcomes and data analysis of the research objectives, the following conclusions were made:

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The research concludes that teacher characteristics (Teaching experience, qualification, and ICT training) have a statistically significant influence on teacher's attitudes towards the integration of ICT in mathematics instruction.

The study concludes that teacher characteristics (Teaching experience, qualification, and ICT training) have a statistically significant influence on teacher's preparedness to integrate ICT in mathematics instruction.

5.4 Recommendations for the Study

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This section focuses on institutional recommendations and policy recommendations.

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5.4.1 Institutional Recommendations

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About the research findings, the researcher recommends the following;

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First, the public primary school management should ensure the training of all mathematics teachers on necessary computer skills to enhance their attitude towards the integration of ICT in mathematics teaching.

Secondly, the public primary school management should ensure full functionality and availability of ICT tools for all mathematics teachers to improve their preparedness to integrate ICT in mathematics teaching.

5.4.2 Policy Recommendations

The national government through the MOE should come up with policies inclined towards the introduction of in-service training and necessary knowledge /skills for ICT integration

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among teachers of mathematics in all public primary schools in the country to enhance integration of ICT in mathematics teaching.

5.5 Recommendations for Further Research

The purpose of this study was to investigate the influence of public primary school teachers' characteristics on their attitude and preparedness to integrate ICT in mathematics teaching in Nakuru East sub-county, Kenya. The study focused on the Nakuru East sub county only. This limits the generalization of the findings to other counties. This research selectively captured the influence of public primary school teachers' characteristics (Teaching experience, qualification, and ICT training) on their attitude and preparedness to integrate ICT in mathematics teaching in Nakuru East sub-county only. Therefore, further research can be done to capture other public primary schools in other counties to establish whether the findings were the same.

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APPENDICES

Appendix A: Mathematics Teachers' Preparedness to Integrate ICT

This questionnaire has items on personal background characteristics, ICT skills possessed, and professional qualifications as a teacher. Please read the instruction carefully before responding to the questions. Give your responses as accurately as possible. All the information given will be treated with the utmost confidentiality.

Part I: Demographic information: please indicate your personal information by ticking in the appropriate box (preliminary).

1. Gender: Male [ ] Female [ ]
2. Highest level of education

   M.Ed [ ]

   B.Ed [ ]

   Diploma [ ]

   Certificate [ ]

3. Years of teaching experience

   Less than five years [ ]

   6-10 years [ ]

   11-15 years [ ]

   16-20 years [ ]

   Above 20 years [ ]

4. Have you been trained in the use of ICT in teaching and learning?

   YES [ ]

   No [ ]

5. School location: (Based on proximity to Town)

   Urban [ ]

   Rural [ ]

Part II: Teachers Qualification on Use of Computer Software in Teaching and Learning

(Please tick where it is appropriate)

SN	Activity	Never 1	Rarely 2	Sometimes 3	Occasionally 4	Frequently 5
6.	Word processor, e.g. Ms. word					
7.	Databases e.g. Ms. Access					
8.	Spreadsheet, e.g. excel					
9.	Presentation Software, e.g. prepare drawings, create a presentation, edit and save					
10.	Internet, e.g. set the internet					
11.	e-mailing, e.g. create an email, identify and open a mailbox					

Teachers experience in use of Computers in Teaching and Learning Mathematics

SN	Activity	Never 1	Rarely 2	Sometimes 3	Often 4	All the times 5
12.	I use a computer for learning or practicing skills					
13.	Use a computer as a tool					
14.	Use to prepare lessons					
15.	To find digital learning resources					

16.	To communicate with colleagues					
17.	To analyze student's achievement performance data.					
18.	To make presentations create graphics.					
19.	To process text					

Please indicate by ticking (✓) the appropriate box, how well prepared you currently feel to do each of the following in your mathematics instruction.

SN	**Activity**	**Not prepared 1**	**Not well prepared 2**	**Moderately willing 3**	**prepared** 4	**Very well prepared 5**
20.	Use computers to demonstrate mathematics principles.					
21.	Use computers for mathematics learning games					
22.	Use computers to collect and analyses data					
23.	Use the internet for general references in your mathematics					
24.	Use the internet for data acquisition in mathematics teaching.					

The following questionnaire is meant to evaluate your attitude about the statements. Please indicate the extent to which you agree to this statement based upon your judgment by ticking (√) the appropriate box.

SN	Statements	Strongly disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly agree 5
25.	I feel confident that I can select appropriate software in my mathematics lessons.					
26.	I feel confident that I can use the internet in my lessons to meet specific learning goals.					
27.	I feel confident that I can use presentation software in my class.					
28.	I feel that I will not master advanced ICT skills.					
29.	I sometimes get nervous just thinking about ICT					
30.	Teachers lack in-service training					
31.	Teachers lack the necessary knowledge/skills for ICT integration.					
32.	A computer is an available tool for teachers.					

Thank you

Appendix B: Research Permit

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Appendix D: Key data analysis outputs

Correlations

			Teachers attitude	Teaching experience	Qualification	ICT training
Spearman's rho	Teachers attitude	Correlation Coefficient	1.000	.658**	.750**	.759**
		Sig. (2-tailed)	.	.000	.000	.000
		N	140	140	140	140
	Teaching experience	Correlation Coefficient	.658**	1.000	.551**	.531**
		Sig. (2-tailed)	.000	.	.000	.000
		N	140	140	140	140
	Qualification	Correlation Coefficient	.750**	.551**	1.000	.605**
		Sig. (2-tailed)	.000	.000	.	.000
		N	140	140	140	140
	ICT training	Correlation Coefficient	.759**	.531**	.605**	1.000
		Sig. (2-tailed)	.000	.000	.000	.
		N	140	140	140	140

**. Correlation is significant at the 0.01 level (2-tailed).

Regression

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.893[a]	.797	.793	.20486	1.523

a. Predictors: (Constant), ICT training, Teaching experience, Qualification

b. Dependent Variable: Teachers attitude

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	22.476	3	7.492	178.524	.000[b]
	Residual	5.707	136	.042		
	Total	28.184	139			

a. Dependent Variable: Teachers attitude

b. Predictors: (Constant), ICT training, Teaching experience, Qualification

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
1	(Constant)	.544	.184		2.963	.004	.181	.907		
	Teaching experience	.155	.036	.215	4.264	.000	.083	.228	.586	1.706
	Qualification	.247	.031	.423	7.961	.000	.186	.308	.528	1.893
	ICT training	.465	.057	.407	8.192	.000	.352	.577	.603	1.657

a. Dependent Variable: Teachers attitude

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.636[a]	.405	.392	.31202	1.940

a. Predictors: (Constant), ICT training, Teaching experience, Qualification

b. Dependent Variable: Teachers preparedness to do mathematics instruction

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	9.014	3	3.005	30.863	.000[b]
	Residual	13.241	136	.097		
	Total	22.255	139			

a. Dependent Variable: Teachers preparedness to do mathematics instruction

b. Predictors: (Constant), ICT training, Teaching experience, Qualification

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for B		Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound	Tolerance	VIF
1	(Constant)	2.078	.280		7.432	.000	1.525	2.631		
	Teaching experience	.180	.056	.280	3.237	.002	.070	.289	.586	1.706
	Qualification	.132	.047	.253	2.785	.006	.038	.225	.528	1.893
	ICT training	.220	.086	.217	2.547	.012	.049	.391	.603	1.657

a. Dependent Variable: Teachers preparedness to do mathematics instruction

Appendix D: Snapshot of paper published from the work.

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Influence of Teachers' Characteristics on Their Attitude Towards the Integration of ICT in Mathematics Instruction in Primary Schools Mathematics Instruction in Nakuru East Sub-County – Kenya

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Abstract
There is pressure placed on the Government of Kenya and the private sectors in the country to strive and compete in the digital world in their operations. In particular, the use of Information Communication Technology (ICT) in institutional operations in Kenya is significant, especially in the education sector. Teachers' lack of ICT skills is the main challenge to integration of ICT in the instructional processes in schools. This study sought to find out whether teachers characteristics influence their attitude towards ICT integration in their classroom practice. Teachers' characteristics entailed qualification and teachers' computer competencies, experiences and computer training. The study investigated the influence of teachers' characteristics on their attitude towards integration of ICT in primary school mathematics instruction in Nakuru Town East Sub-county of Nakuru County, Kenya. In the study, a Correlational research design was applied. A total of 1364 primary school teachers in Nakuru Town East Sub-County, was the target population in the study. The accessible population were all the mathematics teachers from the public primary schools from which a sample size of 140 participated in the study. Simple random sampling was used to select five divisions and proportionate stratified sampling was used to select participating schools and teachers in the study. The head teachers in the participating schools were selected purposefully as part of the teachers to provide information about ICT resources. The data was collected using a self-report questionnaire. The experts in the department of curriculum Instruction and Educational Management validated the instrument. The tool was pilot tested in schools in the neighboring county which had similar characteristics as the study are. The reliability of the research instrument was found to be 0.906 which was within acceptable threshold for social science research. Descriptive (frequency distributions, means, and percentages) and inferential statistics (correlation and regression analysis) were used to analyze the collected data with the help of SPSS program version 26. The hypothesis was tested at 0.05 Alpha (α) level of significance. The study established the existence of a strong statistically significant positive relationship ($r = 0.879$, $p < 0.05$) between teacher characteristics and attitude towards the integration of ICT in mathematics instruction. The study established that teacher characteristics (Teaching experience, qualification, and ICT training) were strong predictors of teacher attitude towards integration of ICT in mathematics instruction ($\beta = 0.155$, $p < 0.05$, $\beta = 0.247$, $p < 0.05$ and $\beta = 0.465$, $p < 0.05$) respectively. The findings may help in informing policymakers and teacher trainers to include ICT in both on the job and out of job teacher training programs.

Keywords: Attitude, Information Communication Technology, teacher characteristics and integration of ICT, and mathematics instruction
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1. Background to the Study

World Summit on the Information Society (WSIS) held in Geneva 2003, and Tunis 2005 resulted in clear commitments by governments to foster the achievement of inclusive information society. Promotion of Information and Communication Technology (ICT) use towards internationally agreed 2030 agenda for Sustainable Development enhance inclusive information society (Canazza, 2018). The United Nations Educational, Scientific and Cultural Organization (UNESCO) and the International Telecommunication Union (ITU) have been at the forefront encouraging the coupling of the powerful influence of the Information and Communication Technologies (ICTs) in efforts to achieve 2015 internationally agreed Sustainable Development Goals (SDGs).

The WSIS plan of action captured the goals, which seek to address new challenges of the information society at national, regional and international levels (world summit on information society, 2003). The ten identified targets by WSIS were set to be attained by 2015, two of which are related to education. Their second target was on connecting all primary schools to information and communication technology (ICT), and the seventh one was on adapting all primary schools' curriculum to meet the challenges of the information society (Partnership on Measuring ICT for Development, 2011).

ICT continues to advance in western and Asian countries, African countries are still striving to implement ICT policies, and these widen the digital and knowledge divides (Reffel & Whitworth, 2010). A new partnership

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