INFLUENCE OF TEACHERS' DIGITAL LITERACY SKILLS ON THE TEACHING OF MATHEMATICS IN LOWER PRIMARY SCHOOLS IN KANDUYI SUB-COUNTY, BUNGOMA COUNTY, KENYA

LILIAN AKELLO KARAKACHA

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DECLARATION

Declaration by the Candidate

This thesis is my original work and has not been presented for a degree in any other University. No part of this thesis may be reproduced without the prior written permission of the author and/or University of Eldoret.

_____ **Date** _____

Karakacha Lilian Akello
SEDU/CIM/M/010/17

Approval by Supervisors

This thesis has been submitted with our approval as University Supervisors.

_____ **Date** _____

Dr. Betty J. Cheruiyot
Department of Curriculum and Instruction
School of Education
University of Eldoret, Kenya

_____ **Date** _____

Dr. Nelly C. Andiema
Department of Curriculum and Instruction
School of Education
University of Eldoret, Kenya

DEDICATION

I dedicate this research study to my husband, Mr. Patrick Sindani, my Son Cospernoel, my daughters Cynthia Linda and Christabel Sindani for their support and prayers throughout my study period.

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ABSTRACT

Digital literacy plays a crucial role in modern education and has the potential to improve learning experiences among lower primary school learners in Grade one to three. However, skills in digital literacy influence among teachers teaching mathematics in lower primary schools in Kenya is not well documented. The ultimate purpose of this research study was to investigate the digital skills in teaching and learning of mathematics activities influence in teachers' in Kanduyi Sub County's lower primary schools. Explicitly, the study intended to: determine the level of teacher digital literacy skills, assess the availability of digital literacy devices, examine the extent to which digital devices are used and find out the perception of teachers on digital literacy and teaching mathematics activities. Social constructivism theory guided this research study and adopted a mixed-methods approach. The study target population included 92 and 631 public primary school head teachers and Grade 1–3 teachers respectively with a sample of 23 head-teachers as well as 235 teachers sourced through simple random sampling employing Yamane's formula. Validity and reliability on structured questionnaires, interviews and observation checklists was done on the tools prior to the actual fieldwork. Statistical Package for Social Sciences was used to analyse qualitative and quantitative data for descriptive and inferential statistics following the study objectives. Percentage frequencies, means, standard deviations and correlation analysis, as well as chi-square tests and multiple linear regression were used. Findings were presented via figures and tables as well as descriptive narratives where the study revealed that teachers' digital literacy was at a moderate level and that most schools in the sub-county did not have sufficient digital devices for teaching mathematics. Teachers in this research study moderately applied digital literacy devices in teaching and learning of mathematics activities in schools and most had positive perceptions towards the role provided in enhancing teaching and learning of mathematic activities in lower primary schools in the Sub County. Regression results indicated that there was significant positive influence of digital literacy skills on mathematics teaching on the following order: digital devices availability (β= 0.531, p=0.001), teachers level of digital skills (β=0.359, p=0.001), digital devices usage (β= 0.218, p=0.001) and teacher perceptions (β=0.123, p=0.015). The study in conclusion established significant moderate positive effect of teacher digital literacy skills and teaching of Mathematics subject in lower primary schools. The study recommends that teachers should be adequately provided with digital training programmes, government to support schools in supplying internet, electricity, construction and equipping of computer laboratories. Head teachers needs also to monitor and oversee the integration of digital instruction in teaching and learning of mathematics subject in their schools.

Key words:

Digital literacy, digital literacy skills, mathematics teaching, lower primary schools, technology integration.

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LIST OF ABBREVIATIONS AND ACRONYMS

ANOVA	Analysis of Variance
AU	African Union
CBE	Competency Based Education
CBE	Competency Based Education
COVID-19	Corona Virus Disease in the year 2019
CPD	Continuous Professional Development
DLP	Digital Literacy Programme
ECE	Early Childhood Education
ELM	Emergent Literacy in Mathematics
ICT	Information of Communication & Technology
IM	Interactive Mathematics
KICD	Kenya Institute of Curriculum Development
MOE	Ministry of Education
NACOSTI	National Commission for Science, Technology and Innovation
SPSS	Statistical Product and Service Solutions
TIMSS	Trends in International Mathematics and Science Study
UNESCO	United Nations Education Scientific and Cultural Organisation
UNHCR	Universal Nations High Commissioner for Refugees
ZPD	Zonal of Proximal Development

CHAPTER ONE

INTRODUCTION

1.1 Overview

This chapter consists of background of the study, problem statement, purpose of the study, research objectives and Research hypothesis, Justification and significance, scope as well as limitation of the study, theoretical and conceptual framework as well as operational definition of terms.

1.2 Background of the Study

Education has evolved in a significant way in the digital age calling in a shift in how teachers deliver content and engage learners in learning activities (Asare et al., 2026). Teachers' digital literacy skills has a crucial role in strengthening mathematics instruction at the lower primary level, thereby improving both pedagogical effectiveness and learners' academic outcomes (Bright, Welcome, & Arthur, 2024). Countries such as the Great Britain, United States (US), Germany and Spain, digital literacy has increasingly been embedded in education thus enriching teaching strategies and promoting learner engagement as reported by Mukeshimana & Andala (2024). In line with Madridejos (2024), this integration is essential for cultivating critical thinking and problem-solving abilities moreso in mathematics while the Organisation for Economic Co-operation and Development (OECD, 2021) further observed that teachers who are equipped with advanced digital literacy skills are more likely to implement the innovative teaching approaches that encourages more of interactive learning in mathematics lessons which in turn reflects the growing consensus that technology is a vital element in the effective teaching of mathematics as noted in Bright et al. (2024) findings.

Acoording to Gumiero & Pazuch (2024), regions such as Australia, South America and in Africa schools continue to face significant challenges in embedding digital literacy within the curriculum where insufficient training and resources available to teachers (Adedoyin & Soykan, 2020) becomes a major barrier which limits their capacity to effectively integrate technology into mathematics instruction. The digital divide truly remains evident marked by unequal access to technological tools and limited professional development opportunities for mathematics teachers as reported in Ashiono, Mwoma & Murungi (2018) In Kenyan and study whose disparities have in the end hindered the delivery and effectiveness of mathematics teaching especially at the lower primary level.

In the Sub-Saharan Africa for eaxmple as noted by Ndibalema (2025) digital literacy is regarded as an essential competency for meeting contemporary educational demands where evidence indicates that many African countries are advancing efforts to incorporate ICT into mathematics teaching as added by Agyei, Darko & Benning (2024). However these initiatives are frequently constrained by poor digital infrastructure and limited teacher training whereas digital literacy is actively prioritized, studies report measurable improvements in learners' mathematics performance as reported in Achieng et al. (2024) study.

In east africa, efforts to strengthen teachers' digital competencies are gaining traction as reported widely by Uwineza, Uworwabayeho & Yokoyama (2023) and in with OECD (2021), Governments are increasing investments in professional development programs designed to improve the digital skills of mathematics teachers where the success of these initiatives is however uneven and depends on socio-economic conditions as well as the availability of technological resources and the level of institutional support as added by Bazina, Bimenyimana & Idahemuka (2024). Kiong (2023) acknowledges that when

teachers are digitally competent, learners' achievement in mathematics especially at early grades appear to improve.

Digital literacy is recognized as one of the seven essential competencies in Kenya's Competency Based Education (CBE) and by integrating information and communication technology into teaching and learning where the CBE aims to raise the quality of education as noted in Nyamosi (2024). National policy frameworks including the Basic Education Act (2013) and Sessional Paper No. 1 of 2019 also endorse digital literacy across four pillars which are education and training, ICT infrastructure and policy, as well as digital content and capacity development as reported by Otieno (2024).

Kenya like many of the developing countries has implemented a number of reforms to incorporate technology into education. The Ministry of Education's Digital Literacy Programme (DLP) was launched to build digital skills among learners and teachers for mathematics learning activities (Republic of Kenya, 2017). Where from 2017 onward, the government distributed ICT infrastructure and resources to public primary schools to align with CBE requirements as reported by Otieno (2024). According to Lysenko et al. (2021), supplied equipment included network routers, teacher laptops and learner tablets for classroom use and even though these measures aimed to empower teachers to pass on digital competencies to pupils, Achieng et al. (2024) noted that many teachers still report feeling inadequately prepared to integrate these technologies effectively into mathematics instruction

According to Kibet (2025), the emphasis of the government towards promoting the number of students undertaking Science, Technology, Engineering and Mathematics (STEM) careers, digital literacy introduction in schools was aimed to achieve the objective. Mathematics is a key enabler of achieving CBE competencies through fostering

analytical precision, data interpretation and logical reasoning by students as per (Lysenko, et al. (2021) however, Kibet (2025) on the other hand indicate that integration of digital literacy in mathematics teaching in Kenya's universities was inconsistent and limited as most lecturers preferred traditional lecture methods despite the advantages brought about by use of digital tools like MATLAB, Demos and GeoGebra which consequently could to influence learner engagement and performance in mathematics subject given teacher limited use of the devices.

Bungoma County mirroring the wider Kenyan education system continues to face challenges related to digital literacy in schools where many institutions lack sufficient technological resources and teachers often need additional support to effectively apply digital skills in enhancing mathematics performance as noted by Mwaniki, Nyamu, & Waititu (2024). Previous studies (Achieng et al., 2024) in this county reveal that although interest in incorporating technology into mathematics instruction is increasing, the actual use of digital skills in classrooms remains inconsistent. In addition, research by Simiyu and Kisiang'ani (2024) in addition established that ICT devices were available in only a limited number of primary schools within Bungoma West Sub-County and therefore these gaps highlight the need for deliberate interventions to strengthen teachers' digital literacy for mathematics instruction. However, investigations into the link between teachers' digital literacy and the teaching of mathematics in public lower primary schools remain scarce and thus it is against this framework that the current study explored the relationship between teacher digital literacy and mathematics teaching in lower primary schools in Kanduyi Sub-County, Bungoma County, Kenya.

1.3 Statement of the Problem

The incorporation of digital literacy into schooling especially for primary-level mathematics instruction has become increasingly significant (Skordialos, 2024). Teachers' competence with digital tools can strongly influence how mathematics is taught in lower primary grades, where foundational and formative learning occurs (Laitochova et al., 2022). Conversely insufficient digital literacy among teachers can limit their ability to integrate technology into pedagogy thereby undermining effective teaching and learning of mathematics as noted in Lysenko et al. (2021).

The Kenyan government launched a digital learning initiative in 2017 that provided laptops, routers and tablets to public schools as pointed out by Iminza et al. (2022 in response to instructional gaps and to support the goals of the Competency Based Education (CBE) with the roll out accompanied by teacher training intended to build capacity for using digital resources in classroom instruction, including mathematics lessons (Bartilol, Egesa, & Yungungu, 2025).

While many of the studies recognise the value of teachers' digital skills, there is still limited work that directly explores how these skills influence mathematics teaching in lower primary classrooms, research in related areas has been conducted for instance, on parental ICT support in Bungoma West as reported by Simiyu & Kisiang'ani (2024), teachers' views on digital literacy across Bungoma County (Simiyu, 2025), learners' digital competencies in Homa Bay as noted in Achieng et al. (2024) and the use of digital devices in university mathematics as confirmed by Kibet (2025). However studies that combine both qualitative and quantitative approaches to capture primary school teachers' real classroom experiences within the Sub-County are still lacking.

Despite ongoing training initiatives by the TSC, levels of digital literacy in Kanduyi remain relatively low and the integration of digital tools into mathematics lessons is still limited. In addition there is little local evidence that clearly connects teachers' digital skills with their effectiveness in teaching mathematics at the lower primary level and thus addressing this gap calls for a thorough examination of teachers' current digital competencies and how these skills shape mathematics instruction in the Sub-County.

1.4 Purpose of the Study

The purpose of this study was to determine the influence of teachers' digital literacy skills in the teaching of Mathematics subject in lower primary schools in Kanduyi Sub-County, Bungoma County, Kenya.

1.5 Objectives of the Study

1. To determine the level of teacher digital literacy skills on the Teaching of Mathematics in lower primary schools in Kanduyi Sub County.
2. To assess digital literacy devices available on the Teaching of Mathematics in lower primary schools in Kanduyi Sub County,
3. To examine the frequency to which digital device are used on the Teaching of Mathematics in lower primary schools in Kanduyi Sub County
4. To assess perception of teachers on impact of digital literacy and teaching of Mathematics subject in lower primary schools in Kanduyi Sub County.

1.6 Hypothesis

The study null hypothesis was:

H_{01}: There is no significant influence of teacher digital literacy skills on teaching of mathematics in lower primary schools

H_{02}: There is no significant influence of digital literacy devices availability on teaching of mathematics in lower primary schools

H_{03}: There is no significant influence of digital devices use on teaching of mathematics in lower primary schools

H_{04}: There is no significant influence of teacher perception on digital literacy on teaching of mathematics in lower primary schools

1.7 Justification of the Study

The Competency Based Education introduced the need for digital skills delivery in teaching and learning activities in Kenya's systems of education starting from pre-primary to the university level. This meant that teaching and instruction of all subjects in the education sector needed to factor in digital technology. Digital literacy is a 21st century competency skills and it has been included in the CBE curriculum to support learners and teachers during instruction (Kibet, 2025). Further, the government of Kenya has been promoting the uptake of STEM subjects by students from an early age and one of the strategies that can enhance the learning of mathematics subjects is teachers' integration of digital literacy methods in teaching and learning of the subject as reported by Otieni, (2024).

Therefore, undertaking research to determine teachers level of digital literacy skills is significant to identify areas of improvement in provision of teacher instruction and also attitudinal change towards technology integration in schools. It was also important for this study to be undertaken to establish the degree to which integration of digital technology has been done in teaching and learning of mathematics subjects in lower primary schools as way of establishing if the policies are implemented to which degree in schools. It was therefore important for this study to be undertaken to establish how various efforts made by government in ensuring digitalisation of learning is being implemented in lower primary schools' situation in Kanduyi Sub County, Bungoma County, Kenya.

1.8 Significance of the Study

The study findings are beneficial to lower primary schools' teachers, management of primary schools, learners, curriculum developers, ministry of education, parents and future scholars. To teachers, the study findings provide information on what they need to do in order to ensure successful instructional delivery using digital educational tools in mathematics. The teachers stand to benefit from the study findings as recommendations are made on how the government through the Ministry of Education can support them with respect to provision of adequate instructional support and training on how to operate and use digital educational tools in mathematics subjects teaching.

To primary school's management, the findings of the study are of significant benefit in recommending areas of improvement towards ensuring that CBE core objectives are attained. The areas of recommendations given in this study are in the area of supporting teachers in the use of digital resources and suggestions on seeking external support in setting up digital infrastructure.

Learners stands to benefit from the study findings as recommendations are made on how their teachers will transform their lessons from traditional teaching methods to blended learning approaches. This will result to pupil's improvement in mathematics subject performance. The learners will also benefit as use of digital resources will enable them acquire the necessary digital skills which is important for their learning now and in future days to come. Parents are also informed on the role that are expected to play to support their learners and schools in digital literacy agenda by purchasing the required resources and supporting school projects on digitisation.

To policy makers (Ministry of Education and Kenya Institute of Curriculum Development), the study makes recommendations on the need to strengthen continuous teachers' education in digital training. The study also suggests the need to ensure that Competency Based Education is specific on how teachers can integrate digital technology in teaching of various subjects (learning areas) rather than having general recommendations or provisions.

Future scholars would benefit from study findings especially on how digital technology is integrated in teaching and learning of mathematics subjects in schools for comparative and also new knowledge creation and advancement.

1.9 Scope and Delimitations of the Study

This research study examined how teachers' digital literacy skills influence the teaching of mathematics in lower primary classes carried out in public primary schools within Kanduyi Sub-County, Bungoma County, Kenya. The study therefore focused on several key factors including the level of teachers' digital skills, the availability of digital devices, how often these devices are used in the classroom and teachers' perceptions of how digital tools affect mathematics instruction. The dependent measure was mathematics teaching. Data was collected through use of questionnaire, interview schedule and observation checklist. The respondents for the study were lower primary school teachers (Grade 1 to 3) and head teachers. The data was collected within a period of two months.

1.10 Limitations of the Study

Several limitations were encountered by the researcher during the study process. Some interviews with respective headteachers were rescheduled several times due to their busy scheduling in performing administrative matters in schools lengthening the period of data collection. Secondly the data collection was undertaken during the rainy season (June –

July 2025) making it impossible to reach out to some schools that were located in the interior parts resulting to researchers using different modes of transport (boda boda riding and walking) in order to reach out to the intended target schools. Because of the busy academic schedule, it was not possible to collect questionnaire on the same day and therefore teachers were given at least 3 – 7 days to fill in the questionnaire resulting to the extension of data collection period from one month to two months. Lastly around ten teachers were hesitant to share their experiences with respect to how they integrated technology in mathematics teaching as a worry to be exposed to school management or ministry of education for their non-adherence to teaching standards and to mitigate this limitation, the researcher assured the teachers that the study was for academic purposes and the responses they provided was to be treated with utmost confidentiality. Nevertheless the above mentioned limitations were addressed well and it did not have significant impact on the outcomes of this investigation.

1.11 Assumptions of the Study

The assumptions of the study were:

1. Teachers in lower primary schools within Kanduyi sub county had received training and induction on digital literacy skills prior to their distribution and before being used in their schools.
2. The study assumed that all schools in Kanduyi Sub County have at least digital resources for integration in teaching and learning of mathematics
3. The study assumed that all the research instruments used were adequate to help answer theresearch questions
4. The respondents provided honest and accurate answers with respect to digital literacy skills and teaching of mathematics subject in lower primary schools

1.12 Theoretical Framework

The study was guided by Social Constructivist Theory which provides a helpful lens for understanding how teachers' digital literacy can shape effective mathematics teaching in lower primary classrooms and while developed by Lev Vygotsky, this theory emphasises that learning is a social process and that interaction along with cultural tools such as language, plays a central role in how children develop cognitively. The theory holds that knowledge is constructed through social interaction, a perspective highly relevant to early-grade mathematics where collaborative learning and shared experiences help learners grasp challenging concepts. In Kanduyi Sub-County in Bungoma County, applying social constructivism ideas can illuminate how technology-enabled collaboration can support instructional effectiveness when teachers possess digital literacy skills.

Key concepts within social constructivism framework include the Zone of Proximal Development (ZPD), scaffolding and the mediating role of language and culture where the ZPD posits that learners can attain higher levels of understanding with guidance from more knowledgeable others, enabling scaffolded learning according to Vygotsky (1978) thus suggesting that collaborative problem-solving and its enhancement through digital tools can raise learners' mathematical competence. On the other hand, scaffolding as temporary instructional support and helps students acquire new skills therefore underscoring the value of interactive teaching in cognitive growth as reported by Gowrie (2024).

In classroom practice, social constructivism principles support interactive as well as collaborative approaches that make productive use of digital literacy. As noted by Baker (2020), lower primary mathematics instruction can shift from teacher-centered delivery to active engagement through technologies such as adaptive learning systems and virtual manipulatives, which automatically align with ZPD and scaffolding concepts where these

resources in the end enable differentiated instruction tailored to individual needs and foster peer dialogue and cooperative problem-solving thus reinforcing the social nature of learning emphasized by social constructivism (Kukulska-Hulme & Crime, 2010).

Social constructivism theory has faced critique with some scholars such as Gredler (2009) contending that it overstates the role of social interaction and downplays independent cognitive processes. Others (Sweller, 2019) note that expert guidance is not universally effective for every learner and may yield mixed outcomes but practical application of the theory can also be limited by resource shortages such as insufficient technology or trained staff in under-resourced settings like Kanduyi Sub-County. In additionally as noted by Miller & Seller (2017), the theory's emphasis on language and culture may not fully capture cross-cultural differences in cognitive development

This theory was significant to this study as the use of digital tools in mathematics teaching aligns with social constructivism view of mediated learning, showing how technology can enhance collaboration and engagement and by investigating how teachers' digital literacy affects learner interaction and comprehension, this study evaluates technology's mediating role in early mathematics education and thus applying social constructivism theory principles to contemporary, tech-enhanced classrooms offers important insights into how digital literacy skills among teachers can promote teaching of mathematics activities in Grade one to three classrooms.

1.13 Conceptual Framework

The conceptual framework illustrates the relationship that exists between the independent variable; teacher digital literacy skills and dependent variable; teaching of mathematics activities. The conceptual framework focuses on understanding how teachers' digital literacy affects mathematics teaching and learning outcomes. This framework is structured

around independent variables that include teachers' competency level on digital literacy, availability of digital devices, usage of these digital devices in classroom learning and teachers' perception on the effect of digital devices.

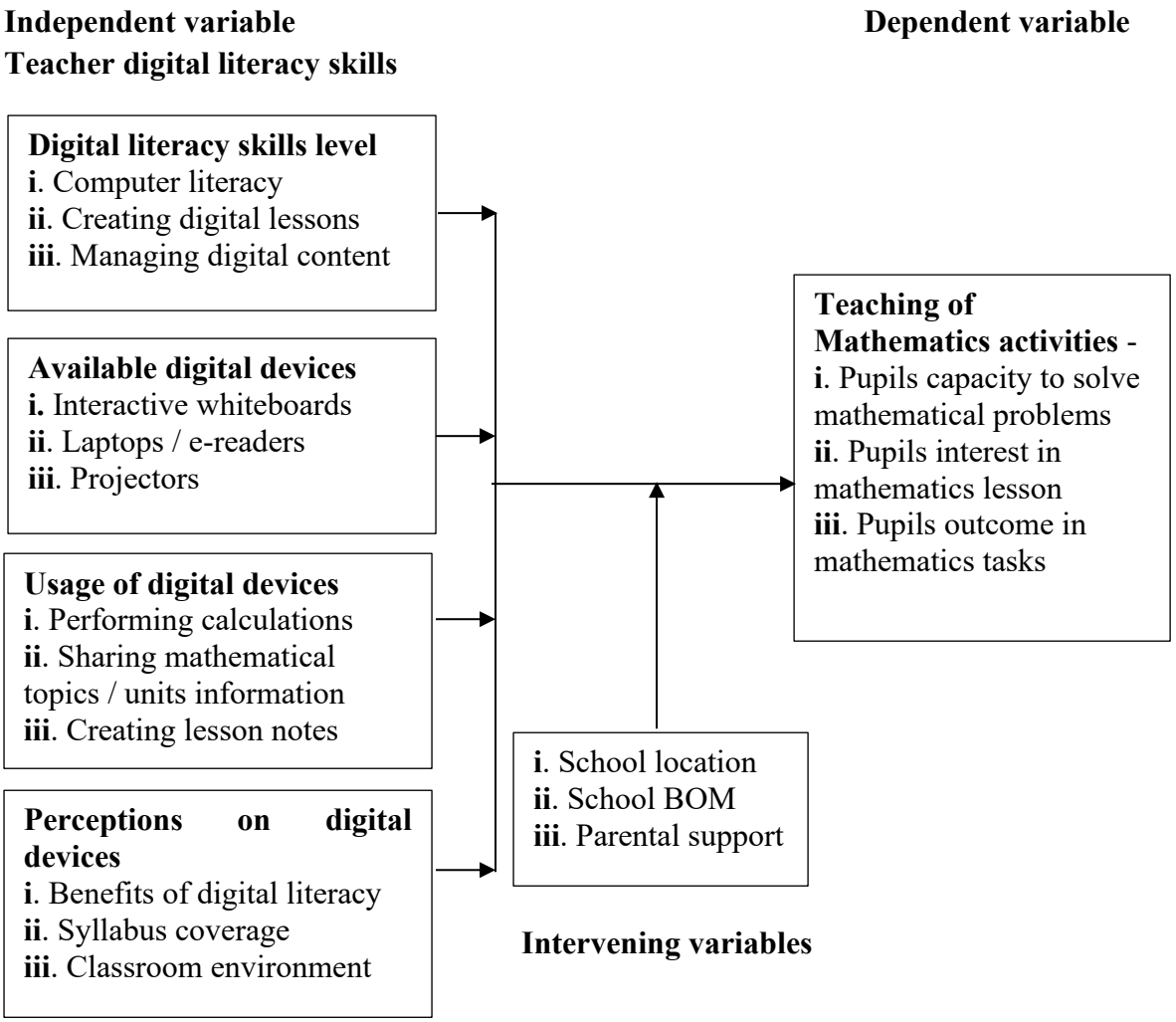

Figure 1.1: Teacher digital literacy and teaching mathematics activities in lower primary schools

(Source: Author, 2025)

The independent variables play a significant role in determining the effectiveness of digital literacy in mathematics teaching. Teachers' perceptions towards digital learning influences teachers' willingness to adopt technology, while teachers' competency on digital skills affects their ability to select and integrate appropriate digital tools. Teachers'

ability to use technology and resources directly impacts the quality of instruction and implementation quality of digital tools ensures that technology is used effectively in lesson plans.

The dependent variable in mathematics activities was measured through several indicators. Learner engagement levels during mathematics activities, learners' performance in math tasks, pupil's capacity to solve mathematical problems and pupils interest in mathematical lessons. The end result was learners acquisition of mathematical skills hence performance improvement. Nevertheless, the relationship between the independent and dependent variable could be influenced by intervening variables; location of schools, availability of supportive infrastructure (electricity, laboratories and internet), schoolboard of management and parental support. To limit the influence of intervening variables, the study was conducted in public primary schools involving teachers of lower primary and principals as respondents for the study.

1.14 Operational Definition of Terms

The following terms should be understood as defined below:

Competency based education: refers to an education curriculum currently being implemented in Kenya which focuses on learners' acquisition of practical skills, core competencies and holistic development other than rote memorisation. It is the precursor of competency based curriculum.

Digital ability: refers to the ability to do something efficiently by use of digital devices, tools and networks for various purposes like communication.

Digital devices: refers to educational materials and tools delivered through digital platforms, such as software, apps and online content used to support knowledge transfer of mathematics activities in lower primary schools.

Digital Literacy: refers to the ability to find, evaluate and communicate information using digital media platforms, combining technical and cognitive skills to create, evaluate and share information effectively.

Mathematics Activities: refers to educational tasks and exercises designed to teach mathematical concepts, often enhanced by digital tools and resources to improve understanding and engagement.

Teacher's perceptions: refers to educators' beliefs and comfort levels with using digital devices in teaching, influencing their willingness to adopt digital tools.

Teachers' Digital Literacy competencies: refers to the teachers' level of knowledge and understanding of digital tools and their application in mathematics activities instruction.

Use digital devices: refers to the practical incorporation of digital devices into mathematics learning teaching practices.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter is intended to examine key issues relating to teachers' digital literacy skills and their influence on Mathematics teaching in lower primary schools. It first reviews the digital competence of lower primary school teachers before considering the digital devices used in teaching and learning Mathematics, then explores the extent to which these devices are integrated into Mathematics instruction and learning activities and also discusses teachers' perceptions of how digital literacy affects the teaching as well as the learning process in Mathematics, alongside relevant conceptual and empirical literature and finally concludes with a summary of the literature and the gaps identified.

2.2 Teacher Digital Literacy Skills Level and Teaching of Mathematics Activities

Digital literacy is progressively recognised as a critical competency for educators, particularly in fostering innovative teaching and engaging learning experiences as noted in Voogt & Roblin (2012) study. According to Asare et al (2026), Digital literacy is the competencies required to use digital technologies effectively in education including the abilities to access, evaluate and produce information digitally. Its integration in educational practices has become vital particularly in mathematics teaching for lower primary schools going beyond basic technical know-how, demanding that teachers skilfully employ digital tools and resources to design engaging and pedagogically sound learning experiences as noted by Encanto (2022).

Technology increasingly shapes classroom practice and digital literacy and has become central to improving instruction especially in mathematics which requires both conceptual understanding and procedural fluency as noted by Joshi et al. (2023). Ultimately,

successful integration of digital devices into mathematics lessons depends largely on teachers' proficiency which can strongly influence student engagement and achievement (Hattie, 2012) with proficiency varying considerably and producing uneven educational outcomes (Yarkwah et al., 2024). Research shows that while some teachers demonstrate sufficient digital literacy, many face challenges integrating technology into their instruction with challenges often rooted in limited training and scarce resources as well as in weak institutional support according to Nurzhanova et al. (2024) findings.

Teachers' professional knowledge also affects lesson planning and the effective incorporation of digital technologies. Gumiero and Pazuch (2024) carried out a systematic literature review of forty two (42) peer-reviewed articles to examine teachers' professional knowledge for teaching mathematics with digital technologies. Their analysis in the end found consistent patterns across the studies in theoretical frameworks, objectives and methods and resulted in a classification of teacher professional knowledge into areas that have been developed and those that still require further attention. Whereas Gumiero and Pazuch (2024)in their study focused on teacher professional knowledge, this study went further to examine how professional knowledge influenced teaching and learning of mathematics subjects by collecting primary data.

Pre-service teachers are expected to have adequate digital literacy and the ability to use technology more effectively in teaching as well as in learning. In Kazakhstan, Nurzhanova et al. (2024) carried out a comparative study on pre-service teachers' digital literacy and technology-use skills across several universities and while using a relational survey design with 209 participants, the study found that overall levels of digital literacy and technology use were relatively high. However the differences emerged based on gender and academic level with male pre-service teachers reporting higher levels of technology-use skills than

their female counterparts and students in higher years demonstrating stronger digital literacy and technology-use abilities. Finally, a key limitation here is that it was conducted in a university context whereas the present study focuses on practicing teachers at the primary school level.

Similarly in Nepal, Joshi Adhikari Khanal and Belbase (2023) examined how teachers' use of communication tools collaborative practices, digital skills and software proficiency influenced learners' communication behaviour during mathematics lessons. The study based on a cross-sectional online survey of 466 mathematics teachers revealed that teachers' digital skill levels were generally low and also highlighted that the use of communication tools, collaborative approaches and efforts to improve digital and software skills significantly influenced students' communication in mathematics classrooms. However, this study was conducted at the secondary school level, while this current study focuses on lower primary education.

A research by Aidoo et al. (2022) focused on Ghanaian teachers' digital literacy and its implications for teaching practices. The study utilised a structured questionnaire method to gather data from primary school mathematics teachers and the findings demonstrated a moderate level of digital literacy even though teachers reported challenges such as lack of motivation and infrastructure, findings indicated that higher digital skill levels correlated with improved learner performance. The study in the end concluded that improving digital skills is critical but emphasized that socio-economic factors were not fully taken into account thus highlighting a need for further research in varying contexts.

In Nigeria, Adetayo (2023) in his study examined the effects of teacher training on the effective use of digital resources mathematics classrooms involving pre-and post-training assessments of 100 teachers. The findings indicated significant improvements in teaching

effectiveness in post-training even though a lack of ongoing support in post-training, representing a gap that requires further investigation, particularly in rural settings like Kanduyi Sub County was highlighted. Thus methodological limitations in focusing solely on urban regions suggested the need for studies in rural contexts which this research study seeks to explore.

2.3 Digital Literacy Devices Availability in Teaching of Mathematics

Due to the changes brought by technological revolution various digital devices and tools and resources have been developed to support the integration in teaching and learning activities in schools. A study by Johnson et al. (2020) investigated the availability of digital resources in primary education across various countries and while utilising a quantitative survey method, the researchers gathered data from over 100 schools. Its findings indicated significant disparities in resource availability with urban schools demonstrating higher access to digital tools compared to their rural counterparts thus concluding that technological access correlates with educational successes.

Despite of the proliferation of educational technologies, teacher surveys have indicated relatively low levels of technology integration in mathematics lesson delivery in Ghanaian Senior High Schools and therefore, Agyei, Darko and Benning (2024) in their study examined how Senior High School mathematics teachers use the available technology resources in their pedagogy in Ghana. An explanatory sequential mixed methods design was mathematics teachers were selected using a stratified sampling technique and the results showed relatively low levels of technology usage as modification or redefinition in mathematics lesson delivery. However the calculator was reported as the predominant technology frequently used by mathematics teachers as substitution and augmentation in their classrooms and therefore the results in addition revealed that mathematics teachers

could only use technology to facilitate their pedagogical activities, used digital technologies to prepare for lessons, assist in computational tasks during class (substitution) and validate mathematical solutions (augmentation).

Yarkwah et al. (2024) in their study examined the digital literacy of pre-service mathematics teachers using a descriptive, quantitative design and from a population of 105, a simple random sample of 80 participants was selected and data were gathered via questionnaires. A majority of respondents reported using various digital tools to support classroom instruction with graphics, animations, quizzes as well as educational games cited most often. Participants thus demonstrated competence in word-processing and cloud-based applications, videoconferencing for online discussions, connecting devices to the internet and using appropriate search engines thus the authors identified key digital-literacy domains for these teachers as effective data collection, evaluation, management and processing using digital resources, responsible online behaviour and productive teamwork through digital tools.

In Zambia, Chama and Subaveerapandiyan (2023) investigated secondary-school teachers' perspectives on obstacles to teaching digital competencies where in this case data was collected from 20 Lusaka schools using a survey of 281 teachers via a structured questionnaire. Although many Zambian teachers have access to digital devices and exhibit moderate to high digital-literacy levels, the study found persistent barriers to meaningful curricular integration notably poor alignment between technology and curriculum, high costs and limited availability of equipment and thus the gap coming out here is that it was conducted in secondary schools whereas this particular study was in primary schools.

Irakarama et al. (2024) explored which ICT tools mathematics teachers use most frequently and their attitudes toward ICT in instruction. Using a descriptive approach that

combined qualitative and quantitative methods, the study found that ICT strongly engages teachers and learners, facilitates interaction with mathematical concepts and encourages exploratory learning. The authors recommended several newer ICT tools, software and applications for use by teachers, learners and secondary schools. This study departs from Irakarama et al. by examining teacher digital devices adequacy and its influenced on mathematics teaching in primary school level.

In Kenya, Kosgei, Kipkoech and Limo (2023) examined the availability of infrastructure supporting digital learning in Uasin Gishu County after COVID-19. Employing a descriptive design with questionnaires and interviews, the study reported that infrastructure positively and significantly influences digital learning in public universities. Nevertheless, the researchers noted ongoing challenges, particularly poor network access in some areas, which hinder the learning process. The study departs from Kosgei et al. which was undertaken in university setting while this present study was undertaken in primary school setting aiming to determine digital literacy devices availability and their influence on mathematics learning in schools.

An investigation by Achieng, Ogola and Muchanje (2024) evaluated ICT infrastructure in public primary schools with the aim of developing learners' digital skills. From a target population of 5,713, the sample included 571 respondents (8 head teachers, 78 teachers and 485 Grade 6 learners). Their findings showed that most schools in Kasipul lacked internet connectivity and only 32.1% had computer labs. While many teachers possessed basic digital-literacy skills, only 23.2% had received formal training in digital literacy. The study dependent variable was development of learners digital skills while this particular study examined learners mathematics learning as a result of availability and use of digital devices.

A research by Otieno (2024) examined the readiness of public primary schools in Rachuonyo South to integrate digital literacy into instructional practices with the goal of equipping learners with digital skills. The study employed a concurrent embedded design targeting a population of 5,713 and sampling 571 participants which included 8 head teachers, 78 teachers as well as 485 Grade Six learners. In this particular study, the findings revealed that only 37.5% of schools had computer laboratories and just 23.2% of teachers had received digital literacy training organized by the Teachers Service Commission (TSC) or the Ministry of Education (MoE) and thus a key gap identified in the study was the lack of assessment on how digital literacy skills influenced mathematics subject classroom instruction which is an issue that the current research sought to address.

In Bungoma, County Wafula and Amudavi (2025) in their study assessed the effects of Digital Literacy Program (DLP) in ECDE centres in Kanduyi Municipality. The study focused on three (3) tenets of the programme which were Infrastructure Facilities; Choice of Digital Devices and Business Continuity Plans (BCP). Purposive sampling targeted only respondents involved in with knowledge of or affected by the Digital Literacy Program in the target area were used and concluded that digital literacy program played a major role in time management, improved literacy and communication skills among pre-schoolers and made it easier to obtain relevant and important information. The gap thus created from this particular study is that it was conducted in pre-schools while the present study was undertaken in lower primary schools. The review of empirical literature has also show that no study has yet to be conducted to evaluate adequacy of various digital devices to support mathematics teaching as well as learning in schools an issue that this study focuses on.

2.4 Digital Device Use in the Teaching of Mathematics

The rapid advancement of digital technologies has transformed curriculum instructional process in schools compelling educators to integrate these devices into their teaching and learning activities as reported by Gani et al. (2021). In mathematics education, the effective use of digital tools fosters a more interactive and constructive learning environment that supports deeper comprehension as noted by Ampofo, 2019) and thus recognising this shift is vital as it influences not only teaching effectiveness but also learner engagement and academic achievement as Chieng, & Tan (2021) added.

With technology becoming increasingly embedded in education exploring its role in mathematics instruction is critical given the subject's reliance on interactive and visual methods as Tenhovirta et al. (2022) notes. According to Chigona (2020) digital instructional devices have been acknowledged widely on their potential to enhance teaching strategies and learner participation especially in mathematics and their integration can improve understanding, encourage active learning and address diverse learning needs as noted in Haleem et al. (2022) study wherein example, devices such as tablets, interactive whiteboards and specialized educational software enable more personalized learning experiences, making mathematical concepts easier to grasp.

Assessing how widely digital devices are adopted in schools is crucial to understanding their real impact on instructional quality as Goz, Bahçekapili and Yilmaz (2018) highlight that digital devices can strengthen teaching effectiveness by complementing traditional approaches and offering broader learning opportunities. However, despite their benefits, Consoli, Desiron and Cattaneo (2023) found out that their use in classrooms remained limited owning largely due to challenges such as insufficient training, lack of adequate resources as well as resistance from educators and therefore examining these barriers is

key to addressing the underutilisation of digital tools and ensuring their effective integration into mathematics teaching at the lower primary level.

In Sweden, Viberg, Gronlund and Andersson (2023) observed that integrating digital technology into classroom learning present significant challenges in their study which examined three secondary school mathematics classrooms, exploring how teachers sought to enhance instruction and student learning through the use of a digital tool. Findings from interviews and classroom observations showed that the main barrier to student learning was the lack of a well-developed social artefact where students struggled to use the tool effectively when teachers failed to establish shared practices for its use. Moreover when teachers themselves did not actively engage with the tool, they were unable to fully grasp how students could benefit from it or provide adequate support in combining teacher guidance with digital instructions thus the study focused on many areas of instruction whereas the present study centered on mathematics teaching in schools.

In Malaysia Kim-How et al. (2022) study was to identify the teaching styles and problems that are faced by teachers in cultivating digital literacy skills for the topic of quadratic equations while employed a qualitative approach by adopting the structured interview method that involved four participants from three districts. Findings showed that the importance of digital literacy skills in quadratic equation comprises the aspect of motivation, space saving, conducive environment and fostering thinking skills as well as diversity of resources. The results indicated that the teachers' teaching approach is based on existing hardware and software such as the Microsoft software, Google software, teaching aids, the Internet resources and mobile device applications in this study.

In Nepal, Acharya (2022) explored the existing practices of digital technology application in teaching and learning mathematics with the data collected through the interview and

observation guidelines as well as focus group discussion. The study concludes that the use of technology in mathematics learning is increasing day by day and mostly mathematics teachers and students are using digital technology in mathematics teaching and learning thus the gap coming from this research study is that it was qualitative in nature while the present study was a mixed method research study.

In Ghana, Mensah (2017) investigated the extent of ICT use among mathematics teachers in their instructional delivery using a cross-sectional survey design and a stratified sampling technique used to select 120 mathematics teachers from 24 public Senior High Schools (SHS). The study revealed that mathematics teachers had favourable attitudes towards the use of ICT in teaching mathematics and further showed that most teachers were competent in the use of ICTs such as Microsoft office word, PowerPoint, Excel and Calculators and a positive correlation between mathematics teachers' use of ICT and competences within secondary school setting while the present study was in primary school

Further et al. (2023) assessed the frequency to which technology was used by mathematics teachers in teaching the subject in senior secondary schools using a cross-sectional survey research design that combined qualitative and quantitative data sources guided the research. Results indicated that most educators applied manipulatives during mathematics class instruction and protractors were regularly utilised with manipulatives compared to cardboards and graph boards which were rarely used by teachers in teaching of mathematics subject but, teachers were found not to have used computer game programmes like Globaloria, stepping stones 2.0 comprehensive mathematics, geometry pads, calculators, mobile phones or virtual protractors as digital and computer based devices in their mathematics teaching. The gap coming from this research study is that it

was conducted among the senior secondary school level but the present study was in primary school.

In Rwandam, Kayonza District, Mukeshimana and Andala (2024) examined the impact of technology use on mathematics performance in public secondary schools using a descriptive survey design targeting a population of 199, comprising 145 mathematics teachers and 54 head teachers, with a final sample of 155 respondents. The findings revealed that technological tools such as digital devices interactive whiteboards and educational software are commonly integrated into mathematics instruction, with 84.1% of teachers affirming that these tools improve problem-solving skills and in addition online platforms like Google Classroom were found to significantly enhance learning outcomes. Despite these benefits more than 60% of schools reported challenges including poor internet connectivity and limited access to digital resources and therefore these disparities in technological access contributed to unequal improvements in student performance across schools. The gap emanating from this particular study is that it was conducted within secondary school levels while this study was in primary school.

In Kenya, a study by Mwaniki, Nyamu and Waititu (2024) examined the strategies mathematics teachers employed in integrating ICT into classroom instruction using a descriptive survey design where the study found that projectors, printers and smart televisions were the main ICT tools available, with GeoGebra being the most frequently used software. Teachers also relied heavily on PowerPoint presentations and whiteboard displays to facilitate mathematics lessons thus the gap coming from this study is that it was conducted in secondary school level but the present study was in primary school.

Further, a study by Mwangi (2024) investigated the influence of digital learning tools on student performance in Kenya through a desk study approach which relies on secondary

data sources. The findings in the study indicated that digital tools enhance student engagement by providing interactive and accessible content while supporting personalized learning that allows learners to progress at their own pace, however, the study also highlighted challenges such as unstable internet connectivity and limited digital literacy among teachers which reduce effectiveness. A key gap in Mwangi's research is its reliance on secondary data whereas the present study utilised primary data to draw conclusions on how digital devices directly impact mathematics learning in schools.

2.5 Teachers Perceptions on Digital Literacy Skills and Mathematics Teaching

The views that teachers have towards digital technology could determine the level at which they are integrated in teaching and learning process. Therefore, this section seeks to establish how various researchers have found with respect to perceptions of teachers on digital literacy skills and mathematics teaching. In Turkey, Ovez and Demir (2023) examined secondary school mathematics teachers' digital literacy self-efficacy, e-learning readiness, technology acceptance and attitudes toward distance education during the pandemic. A total of 108 teachers from Uşak province and its districts, selected through convenience sampling, participated in the study. Results showed that teachers' digital literacy self-efficacy as well as e-learning readiness and technology acceptance were generally high while their attitudes toward distance education were moderate. Furthermore, there was a strong positive relationship between digital literacy self-efficacy and e-learning readiness which is a moderate positive relationship with technology acceptance and a weak negative relationship with attitudes toward distance education.

In Kumasi, Ghana, Bright, Welcome and Arthur (2024) investigated the effect of technology use in mathematics instruction on learner performance with mathematics interest as a mediating factor using simple random sampling where 216 learners from three

schools were selected. Findings revealed that technology use positively and significantly influenced mathematics performance as did learner interest in the subject. Additionally, technology use had a significant positive effect on learners' interest and the link between technology use and mathematics performance was somewhat mediated by interest showing statistical significance.

Gqoli (2024) explored learners' perceptions of using digital technology in mathematics instruction through a qualitative case study guided by the Technology Acceptance Model where the study involved 20 second-year mathematics learners purposively selected for their rich insights. Data collected through semi-structured interviews and analysed thematically revealed that learners generally had a positive (+ve) attitude toward adopting digital tools for mathematics learning though they also faced challenges while using these tools.

A study in Rwanda by Uwineza, Uworwabayeho and Yokoyama (2023) investigated primary school teachers' perceptions of integrating Interactive Mathematics (IM) software into teaching and learning using an interpretive phenomenological approach where Seven teachers from both lower and upper primary levels selected non-randomly based on gender and teaching experience, participated in semi-structured interviews. Three main themes emerged which were (1) the drawbacks of traditional mathematics instruction (2) the benefits of ICT and interactive mathematics software and (3) the challenges associated with implementing such technologies in the classroom.

Further, Nzayisenga, Niyibizi and Uworwabayeho (2023) examined teachers' perceptions of integrating technology into mathematics instruction in Rwandan day secondary schools in a study involving a survey of 51 mathematics teachers drawn from a population of 61 with 26 of them participating in in-depth interviews. Results in the end revealed that

teachers generally held positive attitudes toward technology integration viewing it as a valuable resource for making mathematics lessons more engaging and interactive as well as learner-centered.

Similarly, Bazina, Bimenyimana and Idahemuka (2024) investigated mathematics teachers' perceptions of technological tool usage in classroom instruction guided by Gregory's constructivist theory of perception employing case study design where the research focused on secondary mathematics teachers from 10 Rwandan schools. Results showed that teachers' willingness to embrace technological tools was shaped by their familiarity with technology and confidence in using it as well as the level of support received in implementation and the study concluded that Continuous Professional Development (CPD) programs focusing on technological integration are essential for strengthening teachers' confidence and enhancing adoption in classroom practices.

In Kenya, Ashiono, Mwoma and Murungi (2018) explored whether the use of ICT in classrooms enhanced mathematics teaching while employing an exploratory sequential mixed methods approach. The findings indicated that ICT empowered teachers to deliver mathematics instruction more effectively and the researchers recommended that teachers be given greater support in utilising ICT for teaching. Unlike Ashiono et al.'s (2018) study conducted in Mombasa County the present research was carried out in Kanduyi Sub-County.

2.6 Chapter Summary

This literature review highlights the influence of teachers' digital literacy in enhancing mathematics education among lower primary school teachers. Studies have demonstrated a positive correlation between teachers' digital literacy skills and mathematics activities instruction. The reviewed literature has shown that while teachers recognize the

importance of integrating technology into their instructional practices, various barriers, such as limited access to devices and infrastructure, hinder consistent application in mathematics teaching.

Table 2.1 Research gaps

Author	Purpose	method	Findings	Gap
Gumiero and Pazuch (2024)	Teachers professional knowledge in mathematics teaching using digital technologies	Systematic literature review of 42 articles	Teachers knowledge influenced mathematics teaching critically	The study relied on secondary data while this study utilised primary data
Ovez and Demir (2023)	e-learning readiness and technology acceptance	Used convenience sample to select 108 teachers of mathematics	e-learning readings had moderate positive relationship with technology acceptance	The study was conducted in secondary schools while this study was in primary school. The sampling used was biased while the sample size used in this study is not biased.
Kim How et al. (2022)	Teaching styles used in cultivating literacy skills in quadratic equations	Qualitative research. Interviewed four respondents	Teachers used mobile devices, Microsoft software and google software to teach quadratic equations	The sample size was small (four) while the current study is high. The study was qualitative while the present study is mixed method study.
Bright et al. (2024)	Impact of technology use in mathematics on students' performance	216 students were selected from 3 schools using simple random sampling	Technology use in mathematics had positive impact on performance	The study was conducted in Ghana secondary schools while the present study is at primary school level
Mukeshimana and Andala (2024)	Technology use effect on mathematics performance	Descriptive survey targeting teachers and head teachers	Technological tools were widely used and they enhanced problem solving in mathematics	Failed to indicate the degree to which technology use affected performance. The study was conducted in secondary schools while this is in primary schools
Achieng et al. (2024)	ICT infrastructure availability and learners digital skills development	Mixed method research design. Sampled 8 heads, 78 teachers & 486 Grade six learners	Most schools did not have internet connection and most teachers had basic skills in digital literacy	Failed to show how teacher digital literacy skills affected learning especially mathematics in schools a focus of this study

Lysenko et al. (2022)	Emergent Literacy in Mathematics (ELM) software use in teaching mathematics in early primary grades	A pilot study which was experimental. Conducted in 7 primary schools involving 14 grade 1 classes	Students exposed to ELM performed better in mathematics than those who were taught using traditional instruction	The study focused on one digital software while the present study involves more than one. The study was experimental while this study is non-experimental

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

The purpose of this chapter was to present the design and methodology that used in the study. It highlighted the research design, target population, sample size determination and sampling procedure, data collection instruments, validity of the research instruments, reliability of the instruments, data collection procedure and data analysis.

3.2. Research Design

This research study employed a descriptive survey research design to investigate the influence of teachers' digital literacy skills in mathematics teaching activities in lower primary schools in Kanduyi Sub-County, Bungoma County, Kenya. The descriptive survey design was appropriate for this study as it allowed for the systematic collection of detailed responses regarding teachers' digital literacy skills and their impact on mathematics activities teaching and learning. By using this approach, the study provided a comprehensive description of the current state of digital literacy in mathematics teaching activities within the selected schools. The descriptive survey design was beneficial as it enabled the researcher to collect first-hand data directly from respondents within their natural teaching environments (Creswell & Creswell, 2023). This approach in the end ensured that the study captures real-world experiences, attitudes and challenges faced by teachers in implementing digital tools in mathematics instruction.

3.3 Area of Study

This research study was carried out in lower primary schools in Kanduyi Sub-County, Bungoma County, Kenya, Western Kenya. The researcher wanted to fill the identified gaps and add more knowledge to the existing research done by other researchers. Also the

research was abit more accessible to many local public schools around. Another reason for conducting the study was due to decline in mathematics performance among pupils in schools in the Sub County compared to the neighbouring sub county. Whereas the introduction of digital technology was aimed at improving teaching and learning of mathematics subjects, research has yet not been conducted in public primary schools in the Sub County which necessitated this study.

3.4 Target Population

Target population refers to the entire group of individuals or elements to which a researcher intends to generalize the findings of a study as per Khan, Raman Sambamoorthy & Prashanth (2023). In this study, the target population comprised all 92 public primary schools in Kanduyi Sub-County where from these schools the study focused on both head teachers and lower primary teachers. In total this included 92 head teachers and 631 teachers from Grades One to Three, as presented in Table 3.1.

Table 3.1: Target Population

Respondents	**Population**
Head teachers	92
Lower primary school teachers (Grade 1 – 3)	631
Total	723

Source: Sub County Director of Education (2025)

3.5 Sampling Design

This explains the method that was used in selecting respondents for the study and the number of respondents that were selected as the sample size from the target population.

3.5.1 Sampling Techniques

Head teachers and teachers of lower primary schools were selected using simple random sampling technique and once selected 23 were automatically picked to participate in the study. For lower primary school teachers, simple random sampling technique was used to select final respondents involved in the study. The simple random sampling ensured that each respondent had an equal chance of being selected in the study.

3.5.2 Sample size

A sample refers to a subset of a population. At times, a whole population can be studied instead of choosing a sample (Creswell & Creswell 2023). Public primary schools in Kanduyi Sub-County formed the sampling units and due to the large target population, samples were drawn for both head teachers and lower primary teachers and the sample size determined using Yamane's (1973) formula as shown.

$$n = \frac{N}{1 + (Ne^2)}$$

Where:

N = Population (631 lower primary school teachers and 92 head teachers)

e = Desired margin of error

n = desired sample size.

This can be computed as:

$n = \frac{723}{1 + (723 \cdot 0.05^2)}$ = 258 respondents (23 head teachers & 235 teachers)

Therefore, the sample size involved a total of 23 head teachers and 235 teachers from lower primary schools (Grade 1 – 3) from Kanduyi Sub County).

Table 3.2: Sample frame

Respondents	Target	Sample size
Head teachers	92	23
Lower primary school teachers (Grade 1 – 3)	631	235
Total	**723**	**258**

3.6 Research Instruments

The study employed three main research instruments: a questionnaire, an observation checklist and an interview schedule.

3.6.1 Questionnaire

A questionnaire was developed to gather data from lower primary school teachers. According to Mugenda and Mugenda (2019), questionnaires are effective tools for collecting data from a large number of respondents within a short time. The instrument included both open- and closed-ended questions aligned with the study objectives. It was organized into three sections: Section A gathered demographic information, while Section B addressed the independent variables and was subdivided into four parts. Part I focused on teachers' digital literacy skills, Part II on the accessibility of digital devices, Part III on the use of these devices and Part IV on teachers' perceptions of digital literacy. Section C dealt with issues concerning the teaching of mathematics within the Sub-County. Several Likert-scale items were included to capture teachers' opinions on the issues under investigation.

3.6.2 Observation checklist

An observation checklist was also employed to complement the questionnaire, enabling the researcher to assess the presence and condition of digital technologies used in teaching mathematics activities in lower primary schools. This tool provided first-hand required information on the availability and use of devices in public primary schools across the sub-

county, serving as a verification method for data obtained through the questionnaire and interviews.

3.6.3 Interview Schedule

In addition, an interview schedule was administered to head teachers of the selected public primary schools in Kanduyi Sub-County. The semi-structured format allowed for probing, giving the researcher flexibility to obtain detailed responses. The interview questions were closely tied to the study objectives and revolved around the key variables under investigation.

3.7 Pilot study

Piloting the research instruments was a crucial step prior to the main study as it enabled assessment of their feasibility, clarity and efficiency before large-scale data collection (Bryman, 2016). Through the pilot process, the researcher was able to identify ambiguities, inconsistencies and possible challenges in the tools. Christensen et al. (2021) emphasize that piloting ensures instruments are well-structured, understandable and capable of capturing accurate and relevant data. The pilot study was carried out in lower primary schools in Webuye West Sub-County, Bungoma County, involving 5 schools. Participants included 5 head teachers and 20 lower primary school teachers. All the instruments were subjected to the pilot process and the feedback obtained guided adjustments, modifications and refinements before the main fieldwork.

3.8 Validity and Reliability of Research Instruments

3.8.1 Validity of Research Instruments

Validity is central to research, as it ensures that instruments accurately measure the concepts they are designed to assess. Creswell and Creswell (2023) define validity as the

degree to which a tool measures what it is intended to measure. Validity also determines the appropriateness of survey questions, ensuring data collected aligns with study objectives. To strengthen validity, the study employed content, construct and criterion validity (Taherdoost, 2016). Specifically, content validity was used to evaluate whether the instruments adequately covered all aspects of the research topic, while construct validity examined their alignment with theoretical frameworks. This was achieved through participant verification, peer debriefing and expert consultation. Specialists in digital literacy, mathematics education and pedagogy reviewed the tools and their feedback was integrated to refine the instruments, enhancing their accuracy and relevance.

3.8.2 Reliability of the Research Instruments

Reliability ensures consistency and dependability of data collected in research (Kothari, 2014). A reliable tool minimizes errors and guarantees that response variations reflect real differences among participants rather than flaws in measurement. In this study, questionnaires were tested for reliability. Several methods exist for assessing reliability, such as test-retest, inter-rater, parallel forms and internal consistency (Mugenda & Mugenda, 2019). The study adopted internal consistency reliability, which measures how closely related the items in a test are, using the split-half method and Cronbach's Alpha coefficient. Cronbach's Alpha, widely recognized for assessing internal consistency (Taherdoost, 2016), was applied and the study obtained a coefficient of $\alpha = 0.745$ across the five variables. This value surpassed the recommended threshold of $r \geq 0.70$ (Kothari, 2014), confirming the instrument's reliability.

3.9 Data Collection Procedures

The researcher requested a letter of introduction from the University of Eldoret and obtain a research permit from National Commission for Science Technology and Innovation (NACOSTI). Additionally, approval was sought from the Bungoma County Director of

Education and Bungoma County Commissioner. Permission was also obtained from head teachers and teachers. Questionnaires were administered to teachers during break time and collected before lessons would resume. Teachers answered the questionnaires after getting informed consent from them. The researcher used an observation Schedule to document the available digital evidences present in schools once permission to access them was granted by the head teacher. The observation checklist was completed each day the researcher administered questionnaires. The researcher also booked appointment with institutional head teacher to conduct interview session. The expectation was that that the interview session would last for 10 – 15 minutes. Data was collected using questionnaires, interviews and observation schedules over a period of one month.

3.10 Data Analysis Procedure

The research study employed statistical methods to analyse quantitative data and thematic analysis for qualitative data. Surveys were used to collect quantitative data and analysed through both inferential and descriptive statistics to identify patterns and association between teachers' literacy in digital and the teaching of mathematics activities. Descriptive statistics included frequencies and percentages, means as well as the standard deviations. In addition chi-square and correlation tests were used to assess the strength as well as direction of the relationship between independent and dependent variables. Multiple regression result was also computed at 0.05 significance level to check on the predictive power of digital literacy on mathematics instructions.

The second stage of analysis involved qualitative data analyses from feedback given from interview schedule and some open ended questions in the questionnaires. Qualitative data was organised following research objectives. Relevant themes (teachers' digital literacy skills) were selected and coded. Kumar (2014) views themes as the basis upon which

arguments and the data extracts are organised, providing headings for discussion and stages in the argument in data analysis. Analysed data (quantitative and qualitative) were presented through narrations, tables and graphs.

3.11 Ethical Consideration

To begin the research process the researcher obtained a research permit from the NACOSTI, authorisation from County Director of Education and permission to collect data from public primary schools' head teachers of various in Kanduyi Sub County. This step was essential because the permit served as official authorization for conducting the study. Before any research instrument was given to the respondent informed consent was first sought through the introductory letter. Following this the researcher briefed all respondents to ensure they fully understand the purpose of the study.

All respondents remained anonymous and strict measures were taken to ensure confidentiality throughout the research process. To further safeguard ethical standards the researcher emphasized that participation in this study was entirely voluntary. Moreover to protect the identities of participants the names of the schools and respondents were kept anonymous. Finally the researcher reassured participants and schools that no risks would be involved in participating in the study. Data collected was safely secured and would be destroyed once the researcher has graduated. The study also ensured that the similarity index was below 20.0% as recommended by University of Eldoret.

CHAPTER FOUR

DATA PRESENTATION, INTERPRETATION AND DISCUSSION

4.1 Introduction

This chapter presents an analysis of the data collected to examine how digital literacy skills among teachers in Kanduyi influence the teaching of Mathematics in lower primary schools. In interviews were conducted on head teachers in their respective school environments to ensure contextual depth. Consequently data analysis involved use of descriptive and inferential statistical techniques in order to derive meaningful interpretations and conclusions.

Furthermore, the presentation and interpretation of the findings are systematically aligned with the study's specific objectives. These objectives include the following:

(i) Assessing the level of digital literacy skills among teachers in the instruction of mathematics activities at the lower primary level in Kanduyi Sub-county.

(ii) Evaluating the availability of digital literacy devices used in the teaching of mathematics activities.

(iii) Determining the frequency with which digital tools are integrated into mathematics instruction.

(iv) Exploring teachers' perceptions regarding the impact of digital literacy on the effectiveness of teaching mathematics activities in the targeted schools.

4.1.1 Instrument's Return Rate

To begin with, the Instrument's return rate is a critical indicator of the validity as well as reliability of research findings. Specifically, it refers to the proportion of questionnaires distributed to head teachers and teachers (grades 1-3) that were successfully completed and returned by the targeted participants (Teachers and Head Teachers). Importantly, the

return rate reflects the level of participation by the sampled respondents (school head teachers and lower primary teachers (Grades 1–3), in returning the questionnaires issued.

A high Instrument's return rate is essential in educational research as it significantly strengthens the validity, accuracy and generalizability of the findings (Kothari, 2014). Thus, a high return rate ensures that the data collected is representative of the population under study, subsequently reducing the margin of error. The descriptive analysis below presents the number of questionnaires issued and returned, alongside the overall percentage response. Therefore, the following two tables (4.1 & 4.2) illustrates the descriptive statistical summary of the Instrument's return rates during data collection.

Table 4 1: Instrument Return Rate

	Instruments (Respondents)	No. issued	Returned	Response Rate
1	Head teachers interview	23	18	78.3
2	Checklist	23	21	91.3
3	Teachers questionnaire	235	221	94.0
	Total / Average	281	260	92.5

As shown in Table 4.1, the mean Instrument's return rate is 92.5 in the following order; interview (78.3%), observation checklist (91.3%) and questionnaire (94.0%). This indicates a very high and consistent level of participation among the sampled respondents. Such a descriptive statistic suggests that the majority of targeted participants were successfully engaged in the study. According to Kothari (2014), a response rate above 65% is deemed sufficient for data analysis allowing for the generalisation of the findings to the broader population.

4.2 Demographic characteristic information of the Teachers

In this research study background information was collected on gender of the respondents, teaching experience and highest professional qualification as well as years of service at the current school for both head teachers and teachers. This information is important as it helps to show how these factors may influence the acquisition of Mathematics concepts among learners in Grades One to Three. The teachers were also asked to indicate their gender (Figure 4.1).

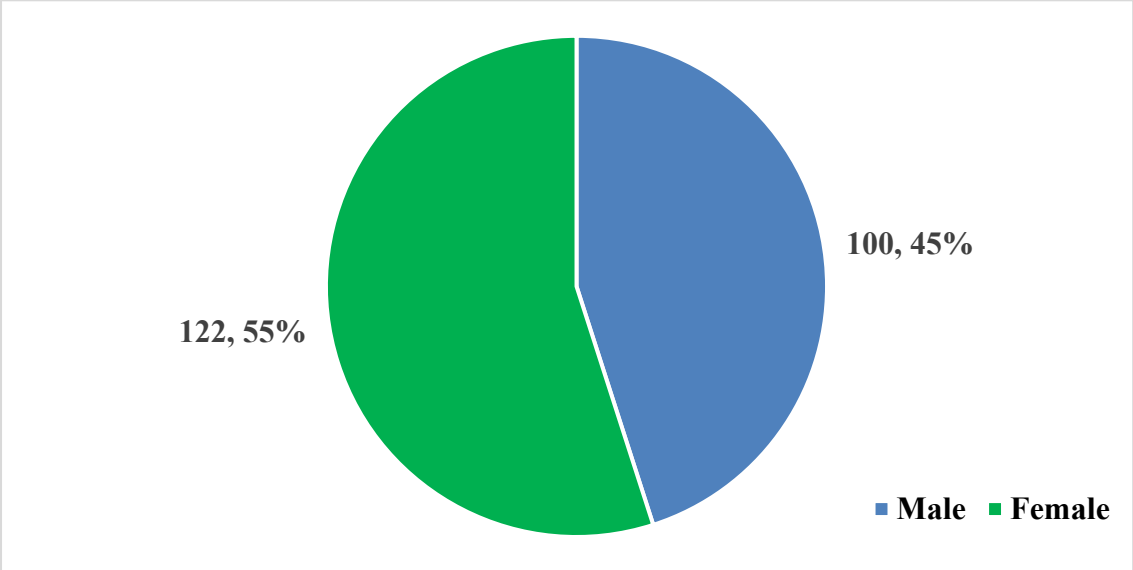

Figure 4.1 Respondents' gender

Results show that 122 (55.2%) of teachers were female and 99 (44.8%) of teachers were male. Therefore, the responses on teacher digital literacy skills came from both male and female teachers. Secondly the teachers were directed to respond to question relating to their level of education. Their responses are presented in Figure 4.2.

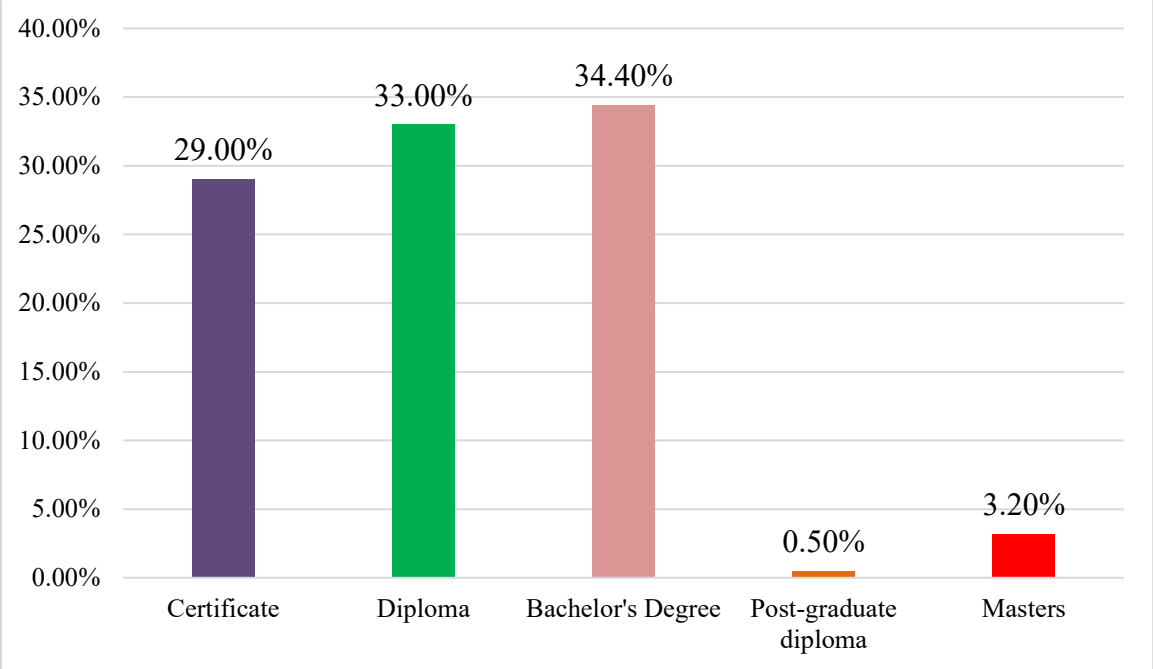

Figure 4.2 Teachers level of Education

Result illustrated that 29.0% of respondents had P1 level of education (certificate), 33.0% were diploma holders, 34.4% had Bachelor's degree, 0.5% post-graduate diploma and 3.2% had master's degree level. The result shows that all teachers are qualified to teach in primary schools owing to the fact that they have met the minimum education qualifications required by Teachers Service Commission to teach in schools as well as provide information on their age bracket (Table 4.2).

Table 4.2 Teachers age bracket

Category	**Frequency**	**Percent**
20 - 30yrs	79	35.7
31 - 40yrs	90	40.7
41 - 50yrs	36	16.3
51 yrs & above	16	7.2
Total	**221**	**100.0**

The results portrayed that 79 teachers (35.7%) were aged 20–30 years while 90 (40.7%) were 31–40 years, 36 (16.3%) were 41–50 years and 16 (7.2%) were 51 years and above. Most respondents (76.4%) were under 40, indicating a relatively young teaching workforce. This is relevant as younger teachers are often expected to have greater exposure to digital tools, making it important to assess their actual digital literacy in relation to Mathematics teaching.

Respondents also provided information on teaching experience, with results presented in Figure 4.3.

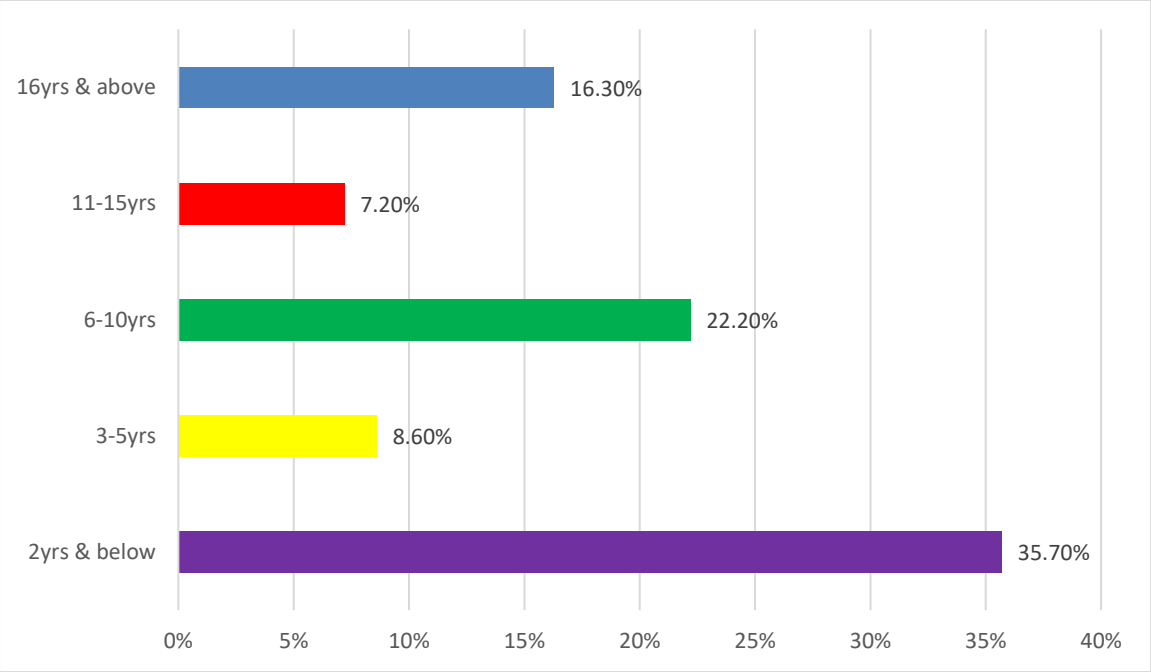

Figure 4.3 Respondents work experience

Findings portrays that 35.7% of teachers had worked for two years and below, 18.6% indicated to have been teaching for a period of 3 – 5 years, 22.2% said they have been teaching for 6 – 10 years, 7.2% have been in the profession for a period of 11 – 15 years and 16.3% had been teaching for a period of 16 years and above. This shows that respondents have considerable number of years teaching in schools and therefore have an

understanding of how mathematics learning has been revolutionised as a result of digital media use in teaching and learning process.

4.3 Level of Teacher Digital Skills in Mathematics Teaching in Lower Primary

Data was collected from head teachers using interviews and from teachers using questionnaires where out of the 18 head teachers interviewed, 9 (50.0%) described teachers' digital literacy as moderate, followed by thoise who indicated average 5 (27.8%) while 2 (11.1%) indicated very low and 2 (11.1%) pointed high. Responses showed mixed views across schools. For example, one head teacher noted that

"*some teachers are confident in using digital tools while others are on their way still developing these skills*" (Head Teacher 15).

Another described the level as moderate explaining that teachers can access and use digital devices during teaching, though not consistently (Head Teacher 1). In contrast some reported low competency with one stating that certain teachers are unable to operate digital devices independently and often require assistance (Head Teacher 6). Overall the findings suggest that while a section of teachers can use digital tools a considerable number still lack the confidence and independence needed for effective integration in classroom practice. This points to limited capacity for consistent use of technology in teaching which may also affect learners' exposure to digital learning experiences. Respondents teachers were also requested to self-rate their digital literacy levels as very low, low, moderate, high or very high as presented in Table 4.3.

Table 4.3 Teachers digital literacy skills in teaching of mathematics

Teachers digital literacy	Very low	Low	Moderate	High	Very High	Mean	Std. Dev
Handling digital tools	4 (1.8%)	13 (5.9%)	125 (56.6%)	45 (20.4%)	34 (15.4%)	3.42	0.88
Assessing digital information	2 (0.9%)	32 (14.5%)	113 (51.1%)	40 (18.1%)	34 (15.4%)	3.33	0.94
Ability to use spreadsheets / data base applications	1 (0.5%)	51 (23.1%)	119 (53.8%)	33 (14.9%)	17 (7.7%)	3.06	0.84
Finding mathematical information through search engines	0 (0.0%)	4 (19.0%)	119 (53.8%)	25 (11.3%)	35 (15.8%)	3.24	0.94
Creating new information through digital devices	0 (0.0%)	25 (11.3%)	120 (50.3%)	46 (20.8%)	30 (13.6%)	3.37	0.86
Sharing of information through digital devices	0 (0.0%)	31 (14.0%)	99 (44.8%)	44 (19.9%)	47 (21.3%)	3.48	0.98
Creating and conducting in digital classes	0 (0.0%)	65 (29.4%)	100 (45.2%)	21 (9.5%)	35 (15.8%)	3.12	1.01
Composite score						**3.29**	**0.92**

The results findings indicated that 56.6% of teachers reported an average ability in handling digital tools, while only 35.8% considered themselves highly competent. Overall the mean score (M = 3.42, SD = 0.88) shows that teachers' competence in using digital equipment was largely at a moderate level which may be linked to limited exposure to digital technologies, continued reliance on print-based teaching materials, or low motivation to engage with digital tools.

In terms of information evaluation, slightly over half (51.1%) of the respondents rated their skills as average while 33.5% reported strong competence in assessing digital information. Similarly more than half indicated an average ability to use spreadsheets and database applications (53.8%). However 23.1% reported low proficiency and only 22.6% demonstrated strong competence with the overall mean score (M = 3.03, SD = 0.84) suggesting moderate capability in using applications such as Excel. Given the numerical nature of Mathematics limited spreadsheet skills may restrict ability of the teachers to fully integrate digital tools into instruction. Regarding internet use 53.8% of teachers reported average ability to search for mathematical content online 19.0% had low ability and 27.1% demonstrated high competence. On digital content creation half of the respondents (50.3%) reported moderate skills 11.3% low and 34.4% high ability with an overall mean of 3.37 (SD = 0.86). In relation to information sharing through digital platforms 44.8% indicated moderate ability while 41.2% demonstrated high or very high competence and 14.0% reported low skills.

Findings further show that about a quarter of the respondents (29.4%) were unable to design or conduct digital lessons 45.2% reported moderate ability and only 25.3% indicated high competence. The mean score (M = 3.12, SD = 1.01) confirms that the ability to deliver digital lessons remains moderate overall. A composite mean of 3.29 (SD = 0.92) further confirms that teachers' digital literacy levels in Sub-County are generally average.

These findings align with reports from head teachers who similarly observed that nearly half of their teachers demonstrate only moderate digital literacy. Comparable results have been reported in studies such as Otieno (2024) which found basic digital competency levels among teachers in Rachuonyo South Sub-County and also concurred with Chama and Subaveerapandiyan (2023) who reported moderate digital literacy among teachers in Zambia. To assess the relationship between digital literacy and Mathematics instruction, respondents were asked to rate learners' achievement in Mathematics classroom activities using a five-point Likert scale ranging from very low (1) to very high (5). The results are presented in Table 4.4.

Table 4.4 Teaching of Mathematics Subject in Lower Primary Schools

Mathematics learning	**Very low**	**Low**	**Moderate**	**High**	**Very High**	**Mean**	**Std. Dev**
Pupils working out mathematical problems	0 (0.0%)	17 (7.7%)	139 (62.9%)	33 (14.9%)	32 (14.5%)	3.36	0.82
Pupils interest in mathematics learning	0 (0.0%)	46 (20.8%)	125 (56.6%)	19 (8.6%)	31 (14.0%)	3.16	0.91
Pupils performance / scores in mathematics tasks	0 (0.0%)	59 (26.7%)	110 (49.8%)	27 (12.2%)	25 (11.3%)	3.08	0.92
Pupils' application of mathematical knowledge	0 (0.0%)	50 (22.6%)	117 (52.9%)	29 (13.1%)	25 (11.3%)	3.13	0.89
Counting & measuring using digital devices	0 (0.0%)	71 (32.1%)	102 (46.2%)	44 (19.9%)	4 (1.8%)	2.91	0.77
Ability to use digital devices to draw or sketch mathematical symbols	5 (2.3%)	92 (41.6%)	75 (33.9%)	18 (8.1%)	31 (14.0%)	2.90	1.07
Composite scores						**3.09**	**0.90**

Teachers reported that pupils' ability to solve mathematical problems was low for 7.7%, moderate for 62.9%, high for 14.9% and very high for 14.5%. Overall this indicates that most learners performed at an average level in problem-solving (M = 3.36, SD = 0.82) and

regarding interest in Mathematics, 20.8% of teachers rated it as low 56.6% as moderate 8.6% as high and 14.0% as very high suggesting that learners' interest is generally moderate which raises concern given the emphasis on STEM education. Similarly performance in Mathematics tasks was rated as low by 26.7%, moderate by 49.8% high by 12.2% and very high by 11.3% indicating an overall average performance level.

On application of mathematical knowledge 22.6% of teachers reported low levels 52.9% moderate 13.1% high and 11.3% very high showing that slightly over half of the learners are able to apply mathematical concepts at a moderate level.

In relation to digital skills 32.1% of pupils were reported to have low ability in counting and measuring using digital tools 46.2% moderate 19.9% high and only 1.8% very high suggesting limited exposure to digital applications in Mathematics activities. Likewise 2.3% of pupils were unable to use digital tools for drawing or sketching mathematical work, 41.6% were rated low, 33.9% moderate, 8.1% high and 14.0% very high, indicating generally weak competency in this area.

A composite mean score of 3.09 confirms that learners' achievement in Mathematics activities in Kanduyi Sub-County is generally at a moderate level and to further assess the relationship between teachers' digital literacy and learners' Mathematics outcomes, a Karl Pearson correlation analysis was conducted as presented in Table 4.5.

Table 4.5 Effect of teacher level of digital literacy skills and mathematics teaching by pupils

		Level of Digital Skills	Mathematics Learning Activities
Level of Digital Skills	Pearson Correlation	1	.567**
	Sig. (2-tailed)		.000
	N	221	221
Mathematics Learning Activities	Pearson Correlation	.567**	1
	Sig. (2-tailed)	.000	
	N	221	221

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

The results indicate a statistically significant moderate positive relationship between teachers' digital literacy skills and learners' mathematics learning activities (r = 0.567, p = 0.001) in public primary schools in Kanduyi Sub-County, Kenya implying that higher levels of teachers' digital literacy are associated with improved mathematics learning outcomes among pupils. The strength of the relationship is moderate, suggesting a meaningful but not exclusive influence.

Overall the findings suggest that strengthening teachers' digital literacy skills is likely to enhance mathematics learning activities in schools, making it an important area for professional development and instructional improvement.

4.4 Availability of Digital Devices and Mathematics Teaching in Schools

The second objective of the study focused on how the availability of digital learning devices influences Mathematics learning activities in public primary schools in Kanduyi Sub-County, Kenya. Data were collected using an observation checklist, interviews and questionnaires. At first, teachers were asked to indicate the availability of various digital devices in their schools. The results of analysis are presented in Table 4.6.

Table 4.6 Digital Devices Availability in Schools

Device	Adequate		Inadequate		Unavailable	
	Freq	**Percent**	**Freq**	**Percent**	**Freq**	**Percent**
Calculator	82	37.1	134	60.6	5	2.3
Computers programmed	37	16.7	159	71.9	25	11.3
E – readers / tablet	83	37.6	111	50.2	27	12.2
Smart phones	146	66.1	59	26.7	16	7.2
Smart boards	71	32.1	78	35.3	72	32.6
Smart TVs	53	24.0	95	43.0	73	33.0
Projectors	68	30.8	111	50.2	42	19.0
Geoboard Making	60	27.1	48	21.7	113	51.1
Wall clock	85	38.5	110	49.8	26	11.8
Digital camera	33	14.9	98	44.3	90	40.8
Composite scores	**72**	**32.5**	**100**	**45.4**	**50**	**22.1**

Findings show that 37.1% of schools had adequate number of calculators, 60.6% said the ones in their schools were not enough for use by learners and only 2.3% did not have. Whereas it was expected calculators to be present only in secondary schools, most primary schools teachers indicate that they too have started using them in mathematics subject learning. The results agree with Agyei et al. (2024) who found out that calculator was the predominant digital device that was used frequently for mathematics learning by teachers and students in schools in Ghana.

Result show that 16.7% had adequate number of computers to be used, 71.9% said the ones presents in their schools were inadequate and 11.3% did not have computers for use. Considering many digital applications are run through the computer systems, the inadequacy of these equipments could be a challenge towards ensuring their use in mathematic activities teaching in schools.

Study findings established that e-readers / tablets were adequate in 37.6% of schools, inadequate in 50.2% of schools and 12.2% of schools in the whole Sub county did not have these devices for use despite government through ministry of education supplying

them to be used by teachers in primary schools. Study results show that 66.1% of teachers said that the smartphones were adequate (individually owned), 26.7% said they were inadequate in their schools and only 7.2% did not have a smart phone thus the result suggests that many teachers are able to access digital resources using their smartphones in schools rather than their computers.

Findings reveal that 32.1% of schools had smart boards, about 35.3% said they were present in their schools but inadequate while 32.6% pointed out that they did not have smartboards in their schools thus encouraging to see many primary schools in Kanduyi Sub County replacing chalkboards with smart boards to enhance digital learning of various subjects in their schools. The findings are supported by Mukeshimana and Andala (2024) research in Rwanda who argue that as part of promoting digital learning in mathematics most public secondary schools had installed interactive smart whiteboards in classes.

Further 24.0% of schools had adequate number of smart TVs, where 43.0% said that the ones available in their schools were inadequate while 33.0% of schools did not have smart TVs meaning that those schools that did not have Smart TVs were unable to access digital education programmes beamed through education television channels like EduTV among others. Study findings also show that 30.8% of schools had overhead projectors where 50.2% indicated to have them but they were not adequate and 19.0% of schools did not have them at all meaning that less than 30.0% of schools had overhead projectors to enable teachers conduct their mathematics learning using PowerPoint slides applications in schools. The findings are comparable to what Asare et al. (2026) found out that projectors were found to be inadequate in most schools in Ghana owing to the incapacity of public schools to purchase the said resources.

Finding show that 27.1% of schools had geoboard marker, 21.7% had them but very few and more than half 51.1% of schools did not have. Whereas this device is mainly used in geometry concepts, most schools have not invested in purchasing them. Result reveal that 38.5% of schools had adequate number of wall clock in their classes, 110 (49.8%) had these devices but were not adequate and only 11.8% did not have wall clock. This means that capacity of learners to study and understands activities of times and seasons could be enhanced if wall clocks are provided in their classrooms. Lastly, study result show that 14.9% of schools had digital cameras, 44.3% said they were inadequate and 40.8% did not have. This shows that most schools did not have digital camera devices. The results are consistent with Mensah (2017) who established that most schools had inadequate number of digital and video camera to use in mathematics learning in public schools in Ghana. Composite data indicate that 32.5% of schools in the sub county had adequate number of digital devices, 45.4% had the devices in few quantities and 22.1% of schools in the whole sub county did not have. The findings agree with Achieng et al. (2024) study that discovered most public primary schools in Kasipul Sub-County had difficulties integrating digital literacy due to inadequate ICT infrastructure facilities.

The researcher also conducted observations from 21 primary schools within Kanduyi Sub County to establish the availability, adequacy and condition of various digital devices. The results are presented in Table 4.7.

Table 4.7 Observation checklist result

Digital device	Adequate		Inadequate		Unavailable	
	Freq	Percent	Freq	Percent	Freq	Percent
Laptop	0	0.0	16	76.2	5	23.8
Desktop	0	0.0	21	100.0	0	0.0
internet	4	19.0	15	71.4	2	9.5
ICT laboratory	3	14.3	14	66.7	4	19.0
E-readers	3	14.3	18	85.7	0	0.0
Smart Phones	14	66.7	7	33.3	0	0.0
Smart boards	0	0.0	1	4.8	20	95.2
Smart Tvs	0	0.0	7	33.3	14	66.7
Projectors	0	0.0	14	66.7	7	33.3
Printers	0	0.0	19	90.5	2	9.5
Scanners	0	0.0	8	38.1	13	61.9
Photocopiers	0	0.0	19	90.5	2	9.5
CD/DVDs	0	0.0	2	9.5	19	90.5
Audi visual devices	0	0.0	12	57.1	9	42.9
Composite scores	**2**	**8.2**	**12**	**58.8**	**7**	**33.0**

Findings from the observation checklist revealed that only 8.2% of schools in the Sub-County had an adequate supply of digital devices. A majority, 58.8%, possessed the devices but in insufficient numbers for effective mathematics learning, while 33.0% of schools lacked digital devices altogether. For instance, smartphones were present in 66.7% of schools, though they mainly belonged to teachers. Conversely, 90.5% of schools did not have CD/DVDs, 95.2% lacked smartboards and 66.7% had no smart TVs. These results aligned with responses from teachers and head teachers, reflecting the overall state of digital device availability for mathematics instruction in Kanduyi Sub-County. The findings are supported by Susuoroka et al. (2023) study which established that audio-visual technologies resources like digital television, pie chart assignment to learners based on TV programme and other audio-visual devices were not present in most schools in Ghana.

During interviews, most head teachers indicated that their schools had access to devices such as computers, laptops, e-readers (tablets), internet connectivity and smartphones. However, more than half (12 head teachers) noted that these resources were inadequate. The researcher's observation further revealed that the conditions under which digital devices were stored in schools were insecure, raising the risk of theft or loss. Additionally, head teachers pointed out that even when devices were available, frequent electricity and internet outages limited their use. This coincides with Achieng et al. (2024) study that showed that computer labs, internet and electricity connectivity in schools was still a major concern. One head teacher emphasised the severity of the problem, noting that the school could go for an entire month without electricity despite repeated requests for reconnection from Kenya Power. The evidence given by Head Teacher No. 13 showed the following:

> *The school has projectors, tablets and also internet access but some are not in good condition due to limited maintenance.*

This indicates that limited internet access constrains teachers' ability to use online digital resources in teaching Mathematics in primary schools in Kanduyi Sub-County and to examine the relationship between the availability of digital devices and Mathematics teaching in schools, a cross-tabulation was conducted followed by a chi-square test for categorical data. The results are presented in Table 4.8.

Table 4.8 Digital devices availability and mathematics teaching cross tabulation

			Mathematics learning			Total
			Low	Moderate	High	
Digital Devices Availability	Adequate	Count	0	6	24	30
		% within Availability	0.0%	20.0%	80.0%	100.0%
	Inadequate	Count	10	130	43	183
		% within Availability	5.5%	71.0%	23.5%	100.0%
	Unavailable	Count	0	7	1	8
		% within Availability	0.0%	87.5%	12.5%	100.0%
Total		Count	10	143	68	221
		% within Availability	4.5%	64.7%	30.8%	100.0%

The cross tabulation shows that schools had adequate digital devices, 80.0% scored higher ratings in mathematics teaching. Secondly, to those that had inadequate digital devices, 71.0% score moderate with respect to mathematics teaching and for those that had no digital devices, 87.5% had moderate levels of mathematics learning activities. To check on the significance of this outcomes, a chi square test was computed and results given in Table 4.9.

Table 4.9 Chi-Square Tests

	Value	**df**	**Asymptotic Significance (2-sided)**
Pearson Chi-Square	40.763[a]	4	.000
Likelihood Ratio	39.059	4	.000
Linear-by-Linear Association	29.040	1	.000
N of Valid Cases	221		

The chi-square test of independence showed a statistically significant association between the variables, χ^2 (4, N = 221) = 40.763, p = .001 confirming that there is a relationship between the availability of digital resources and Mathematics teaching in public primary schools in Kanduyi Sub-County, Kenya. However the findings also indicate that many schools still lack sufficient digital resources to effectively support Mathematics instruction consistent with Achieng et al. (2024), who reported that most public primary schools in Kasipul Sub-County had inadequate digital infrastructure, limiting learners' access to skills required for 21st-century learning, including Mathematics. Overall the findings suggest that improving the availability of digital resources in schools could enhance the teaching and learning of Mathematics.

4.5 Use of Digital Devices and Mathematics Teaching in Schools

The third objective of the study explored the relationship between teachers' use of digital devices in classroom instruction and Mathematics teaching in public primary schools in Kanduyi Sub-County where the data were collected using questionnaires and interviews with head teachers. Teachers were first asked to indicate how often they used different digital devices and applications in classroom instruction, using a five-point Likert scale ranging from never (1), rarely (2), sometimes (3), often (4), to always (5). The results are presented in Table 4.10.

Table 4.10 Extent of Digital Device Use in Mathematics Classroom Instruction

	Never	Rarely	Sometimes	Often	Always	Mean	Std. Dev
Learning online through google classes, YouTube among others	16 (7.2%)	31 (14.0%)	121 (54.8%)	35 (15.8%)	18 (8.1%)	3.04	0.96
Using PowerPoint and projector	10 (4.5%)	63 (28.5%)	110 (49.8%)	27 (12.2%)	11 (5.0%)	2.85	0.88
Online math games	19 (8.6%)	88 (39.8%)	74 (33.5%)	26 (11.8%)	14 (6.3%)	2.67	1.01
Digital mathematical simulation and models	30 (13.6%)	68 (30.8%)	7 (39.4%)	21 (9.5%)	15 (6.8%)	2.65	1.05
Graphics and animation	22 (10.0%)	64 (29.0%)	82 (37.1%)	40 (18.1%)	13 (5.9%)	2.81	1.04
Online math quizzes and games	27 (12.2%)	40 (18.1%)	112 (50.7%)	25 (11.3%)	17 (7.7%)	2.84	1.03
Utilising e-books and e-notes on mathematics activities	21 (9.5%)	65 (29.4%)	79 (35.7%)	34 (15.4%)	22 (10.0%)	2.87	1.10
Composite scores						2.82	1.01

Result show that 54.8% said that they sometimes conduct their learning through google classes, YouTube among others. The mean value is 3.04 with standard deviation score of 0.96 which implies that teachers moderately conduct their learning through the google classes while others do not. This could be due to lack of supportive infrastructure like electricity, internet, even computer gadgets or teacher limited knowledge on how to conduct or watch online lessons. The results differ with Acharya (2022) research in Nepalese secondary schools that showed most learners using Google and YouTube to learn mathematical concepts at secondary school level.

Findings show that 110 teachers (49.8%) sometimes used PowerPoint presentations with a projector during Mathematics lessons 63 (28.5%) used them rarely and only 17.2% reported regular use suggesting that while PowerPoint is occasionally integrated into teaching, its use is inconsistent. The limited application may be linked to constraints such as inadequate preparation time, shortage of projectors, limited technical skills in slide development and insufficient supporting infrastructure such as electricity, laptops and smart boards.

Regarding the use of online Mathematics games, 8.6% of teachers reported never using them, 39.8% rarely used them, 33.5% used them sometimes, 11.8% often used them and only 6.3% used them consistently. These findings indicate that interactive digital learning tools such as online games are rarely integrated into Mathematics instruction in most classrooms suggesting generally low adoption of game-based digital learning approaches in the Sub-County.

Findings show that 10.0% of teachers had never used graphics and animations in Mathematics teaching, 29.0% rarely used them, 37.1% used them sometimes, 18.1% often used them and only 5.9% always used them. Overall the mean score ($M = 2.81$, $SD = 1.04$) indicates that the use of graphics and animations is occasional rather than consistent

suggesting that teachers alternate between using and not using visual digital tools, despite their importance in enhancing learners' understanding and interest in Mathematics concepts.

In relation to online quizzes and games, 50.7% of teachers reported using them sometimes, 18.1% rarely, 11.3% often and 12.2% had never used them. The overall mean score (M = 2.84, SD = 1.03) further confirms that integration of online assessment tools is generally moderate and inconsistent which may be attributed to limited teacher competence in online platforms, inadequate digital resources and internet connectivity challenges.

Similarly, findings indicate that 9.5% of teachers had never used e-books and digital notes in Mathematics, 29.4% rarely used them, 35.7% used them sometimes, 15.4% often used them and 10.0% used them regularly. The mean score (M = 2.87, SD = 1.10) shows that the use of electronic learning materials is also at a moderate level. Despite increased availability of online resources, more than half of the teachers have not fully embraced e-books and digital notes in their instruction with findings contrasting with Agyei et al. (2024) who reported that teachers in Ghana frequently used digital technologies for lesson preparation, mathematical computation and verification of solutions in classroom practice.

Composite scores show that sometimes (mean=2.82, Std Dev=1.01) teachers used digital devices in mathematics instruction in public primary schools in Kanduyi Sub County. Therefore, it shows that not all teachers regularly integrate digital devices and platforms in teaching of mathematics subjects in schools. The information was confirmed by headteachers interviewed who said that the use of digital devices in teaching and learning of mathematics was not regularly used. For instance, Head teacher No. 18 said that:

> *Teachers at all times do not integrate digital technologies due to the large number of learners not be able to access them.*

The responses suggest that overcrowding in public primary schools in Kanduyi Sub-County limits teachers' use of digital devices during Mathematics instruction, however there are a few schools where such tools are still used in classroom teaching for instance, Head Teacher 16 noted the following:

> *Both the learners and teachers use digital devices where the teachers use them as teaching aids and learners watch educational videos during mathematics learning.*

The findings from both teachers and head teachers align with Yarkwah et al. (2024), whose study in Ghana reported that many of the Mathematics teachers still lack the skills needed to effectively integrate appropriate digital resources into teaching and learning activities. However the results differ from those of Acharya (2022) who found that most Mathematics teachers and learners in Nepalese secondary schools actively used digital technologies in teaching and learning. Similarly, Encanto (2022) reported that Mathematics teachers in the Philippines demonstrated strong instructional competence, particularly in content knowledge, pedagogy and digital skills. Overall, these comparisons suggest that many Asian countries are comparatively more advanced in equipping teachers with digital competencies that support effective classroom instruction in Mathematics.

To examine the significant relationship between extent through which teachers use digital devices and mathematics instruction in public secondary schools. The results ae presented in Table 4.11.

Table 4.11 Effect of Digital Devices Use and Mathematics Teaching in Schools

		Digital Device Usage	Mathematics Learning Activities
Digital Device Usage	Pearson Correlation	1	.517**
	Sig. (2-tailed)		.000
	N	221	221
Mathematics Learning Activities	Pearson Correlation	.517**	1
	Sig. (2-tailed)	.000	
	N	221	221

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

The results indicate a significant moderate positive relationship between teachers' use of digital devices and learners' Mathematics learning activities ($r = 0.517$, $p = 0.001$) in public primary schools in Kanduyi Sub-County, Kenya implying that increased use of digital tools by teachers is associated with improved Mathematics learning outcomes among pupils. Overall the findings suggest that consistent use of digital devices in classroom instruction can enhance learners' engagement and performance in Mathematics and as such strengthening teachers' regular integration of digital tools in lesson delivery is important for improving Mathematics learning activities in the current educational context.

4.6 Teacher Perceptions on Digital Literacy Skills and Mathematics teaching

The fourth objective of the study examined teachers' views on digital literacy skills and its effect on teaching and learning of Mathematics subject in lower primary schools in Kanduyi Sub County. The statements were measured on a Likert scale of five. Hence, the teachers were asked to indicate their level of agreement or disagreement on the degree to which digital literacy skills affect teaching and learning of mathematics in their classes. The results of analysis are presented in Table 4.12.

Table 4.12 Teacher perceptions on digital literacy skills in mathematics teaching

Perceptions	Strongly disagree	Disagree	Undecided	Agree	Strongly Agree	Mean	Std. Dev
Use of digital devices has enhanced basic mathematic operations	5 (2.3%)	14 (6.3%)	32 (14.5%)	128 (57.9%)	42 (19.0%)	3.85	0.88
Use of digital devices makes mathematics learning simple and easier/easy understanding	4 (1.8%)	12 (5.4%)	31 (14.0%)	121 (54.8%)	53 (24.0%)	3.94	0.87
Use of digital devices helps to improve pupils' learning/identification of mathematics learning abilities	3 (1.4%)	9 (4.1%)	44 (19.9%)	94 (42.5%)	71 (32.1%)	4.00	0.90
Use of digital devices ensures participation of pupils in learning process	4 (1.8%)	13 (5.9%)	41 (18.6%)	104 (47.1%)	59 (26.7%)	3.91	0.92
Use of digital devices help pupils to get a pictorial representation of mathematical concepts	4 (1.8%)	23 (10.4%)	61 (27.6%)	74 (33.5%)	59 (26.7%)	3.73	1.03
Use of digital devices reduces teacher too much talking in lesson delivery	6 (2.7%)	31 (14.0%)	41 (18.6%)	75 (33.9%)	68 (30.8%)	3.76	1.12
Integration of digital devices ensures child-centeredness in teaching	4 (1.8%)	19 (8.6%)	37 (16.7%)	101 (45.7%)	60 (27.1%)	3.88	0.97
Use of digital devices enhances syllabus coverage	4 (1.8%)	25 (11.3%)	36 (16.3%)	98 (44.3%)	58 (26.2%)	3.82	1.01
Use of digital devices improves presentation of materials for mathematics lesson	3 (1.4%)	16 (7.2%)	48 (21.7%)	101 (45.7%)	53 (24.0%)	3.84	0.92
Use of digital devices in mathematics teaching increases my confidence	3 (1.4%)	22 (10.0%)	22 (10.0%)	124 (56.1%)	50 (22.6%)	3.89	0.91
Composite scores						3.86	0.95

The findings reveal that more than half of teachers (57.9%) agreed and 19.0% strongly agreed that use of digital devices has enhanced basic mathematic operations. This means that teachers believe that there is improvement in teaching mathematics when conducted using digital means. Secondly, research findings show that 54.8% of teachers agreed and 24.0% strongly agreed that usage of digital devices makes mathematic learning simple to teacher and easier for learners to understand. This means that use of digital devices in mathematics teaching improves learning not only the teacher but learners are able to grasp and understand the concepts being taught.

Further result reveal that 42.5% of teachers agreed and 32.1% strongly agreed that the usage of digital devices helps to improve learners' identification of mathematics learning capacities. Therefore, use of these devices facilitates learners to identify and improve mathematic learning abilities by pupils in schools. This view is supported by Irakarama et al. (2024) research from Rwanda that showed that digital use by teachers offered opportunities for learners to interact with mathematical ideas which enabled them to learn and acquire new knowledge and skills in the subject. Study findings also reveal that 104 (47.1%) of teachers agreed and 26.7% strongly agreed that usage of digital devices in mathematics learning activities increased learners' participation in the learning process. This information was confirmed by head teachers interviewed who said that usage of digital devices enhanced learner engagement. Head teacher No. 6 said the following:

> *If the teacher will use digital literacy devices during teaching, the lessons will be more engaging and practicing helping learner understand the concepts being taught even better.*

It is deduced that teachers use of digital devices in mathematics instruction improves learners' activeness and participation in classwork activities.

Result also shows that 33.5% of teachers greed and 26.7% strongly agreed that use of digital devices helped learners to get a pictorial representation of mathematic concepts being taught. This means that learners are able to generate pictorial representation of mathematics concepts when teachers are using the digital devices in schools. This helps them to create meaning and understanding from the images they see through the digital devices. Findings also show that 33.9% of respondents agreed and 30.8% strongly agreed that through use of digital devices, teachers do not speak too much. This means that teachers acts as a facilitator during use of digital devices as they have been set up in a way that they direct instructions to students who are listeners and viewers. The language that is also used in such mathematical programmes is suited for children in lower primary school level.

Findings indicate that 45.7% of teachers agreed and 27.1% strongly agreed that the use of digital devices shifts classroom focus from the teacher to the learner suggesting a move towards learner-centred instruction where learners take an active role in the learning process while teachers act as facilitators.

Regarding syllabus coverage, 1.8% strongly disagreed, 11.3% disagreed, 16.3% were undecided, 44.3% agreed and 26.2% strongly agreed that digital devices help complete the syllabus more efficiently. Overall, the mean score ($M = 3.82$, $SD = 1.01$) shows that most teachers generally agree that digital tools support faster syllabus coverage in Mathematics instruction. In addition, 45.7% agreed and 24.0% strongly agreed that digital devices improve the presentation of instructional materials in Mathematics indicating that visual and interactive tools enhance how content is delivered in class. Similarly, 56.1% agreed and 22.6% strongly agreed that the use of digital devices increases both teacher confidence and learner motivation consistent with Lysenko et al. (2022) who reported that teachers using electronic learning materials felt more confident and comfortable in teaching

Mathematics with technology. Overall, the composite mean score (M = 3.86, SD = 0.95) shows that teachers hold generally positive perceptions of the role of digital literacy tools in Mathematics teaching in Kanduyi Sub-County suggesting that teachers view digital tools as important in improving classroom instruction and learner engagement.

These perceptions are also supported by Bazina, Bimenyimana and Idahemuka (2024), who found that teachers' attitudes toward digital tools are influenced by familiarity, confidence and the level of support they receive during use. Finally a Karl Pearson correlation analysis was conducted to determine the relationship between teachers' perceptions and Mathematics teaching outcomes, as presented in Table 4.13.

Table 4.13 Relationship between teacher perceptions and mathematics teaching

		Teacher Perceptions	**Mathematics Learning Activities**
Teacher Perceptions	Pearson Correlation	1	.395**
	Sig. (2-tailed)		.000
	N	221	221
Mathematics Learning Activities	Pearson Correlation	.395**	1
	Sig. (2-tailed)	.000	
	N	221	221

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

The correlation results indicate a significant positive relationship between teachers' perceptions and Mathematics learning activities in public primary schools in Kanduyi Sub-County ($r = 0.395$, $p = 0.001$) suggesting that teachers' attitudes and views toward digital literacy and the use of digital devices play an important role in shaping Mathematics instruction. The findings imply that when teachers hold positive perceptions, they are more likely to integrate digital tools into their teaching, which in turn supports improved learning outcomes in Mathematics. Although Mathematics is often perceived as a

challenging subject by learners, teachers believe that the use of digital media can make lessons more engaging, improve understanding of concepts, enhance learner motivation and encourage active participation as well as ultimately contribute to better academic performance.

4.7 Overall Influence of Teacher Digital Literacy Skills and Mathematics Teaching

A multiple linear regression analysis was used assesses the predictive effect of digital literacy on the teaching of Mathematics in secondary schools at a 0.05 significance level. The model summary results are presented in Table 4.14(a).

Table 4.14 (a) Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.733[a]	.537	.528	.50428

a. Predictors: (Constant), Teacher Perceptions, Digital Devices Availability, Level of Digital Skills, Digital Device Usage

The correlation for the model is 0.733 with an adjusted R-square value of 0.528 which means that 52.8% of change in mathematics instruction in lower primary schools is dependent on digital literacy in schools. The remaining 47.2% could be explained by other variables that were not integrated in the model. Table 4.14 (b) shows the ANOVA outcomes.

Table 4.14 (b) ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	63.611	4	15.903	62.536	.000[b]
	Residual	54.928	216	.254		
	Total	118.540	220			

a. Dependent Variable: Mathematics Learning Activities

b. Predictors: (Constant), Teacher Perceptions, Digital Devices Availability, Level of Digital Skills, Digital Device Usage

The ANOVA results in Table 4.23, as shown by the F-test value of 62.53 and a p-value of 0.001, suggest that the multiple regression model was statistically significant and robust. This means that the model was capable of explaining the relationship between the independent variables on dependent variable. The regression coefficients as presented in Table 4.14 (c) reveal a more nuanced outcome.

Table 4.14 (c) Coefficients[a]

	Unstandardized Coefficients		Standardized Coefficients		
Model	**B**	**Std. Error**	**Beta**	**t**	**Sig.**
1(Constant)	1.833	.385		4.757	.000
Level of Digital Skills	.359	.052	.361	6.883	.000
Digital Devices Availability	.531	.105	.292	5.068	.000
Digital Device Usage	.218	.055	.226	3.990	.000
Teacher Perceptions	.123	.050	.126	2.455	.015

a. Dependent Variable: Mathematics Learning Activities

The regression equation can be written as:

$$y = 1.833 + 0.359x_1 + 0.531x_2 + 0.218x_3 + 0.123x_4$$

The above results show that there exists significant relationship between the independent variables digital literacy skills; digital devices availability (β=0.531, p=0.001), teachers level of digital skills (β=0.359, p=0.001), digital devices usage (β=0.218, p=0.001) and teacher perceptions (β=0.123, p=0.015) which are all significant.

4.7.1 Hypothesis Testing

The first null hypothesis was:

H_{01}: There is no significant influence of teacher digital literacy skills on teaching of mathematics in lower primary schools

The regression results of this study show a significant positive effect of teachers' digital literacy on Mathematics teaching in lower primary schools in Kanduyi Sub-County (β = 0.359, p = 0.001). Since the p-value is below the 0.05 threshold, the null hypothesis was rejected, confirming that teacher digital literacy has a statistically significant influence on Mathematics instruction. These findings are supported by Ovez and Demir (2023) who reported a significant positive relationship between secondary school Mathematics readiness for digital learning in Türkiye. Overall, the results suggest that higher levels of digital literacy among teachers contribute positively to the effectiveness of Mathematics teaching in schools meaning that teacher digital literacy skills is essential for integration of digital technology in mathematics learning in schools. Joshi et al. (2023) adds that teachers' digital training is essential for developing digitally competent instructors who can transform the traditional mathematics classrooms into a learning environment that is engaging, constructive, supportive and collaborative to learners in a flexible and joyful context.

The second null hypothesis was

H_{02}: There is no significant influence of digital devices availability on teaching of mathematics in lower primary schools

The regression results indicate a significant positive effect of the availability of digital devices on Mathematics teaching in lower primary schools in Kanduyi Sub-County ($\beta = 0.531$, $p = 0.001$). Since the p-value is below the 0.05 significance level, the second null hypothesis was rejected confirming that the availability of digital learning devices has a statistically significant influence on the teaching of Mathematics in lower primary schools in Kanduyi Sub-County, Kenya.

The third null hypothesis was:

H_{03}: There is no significant influence of digital devices use on teaching of mathematics in lower primary schools

The regression results show a significant positive effect of digital device use on Mathematics teaching in lower primary schools in Kanduyi Sub-County ($\beta = 0.218$, $p = 0.001$). Since the p-value is below the 0.05 threshold, the third null hypothesis was rejected confirming that the use of digital devices has a statistically significant influence on Mathematics instruction in lower primary schools in Kanduyi Sub-County, Kenya. The finding is consistent with Bright et al. (2024), who reported a significant positive impact of digital technology use on learners' Mathematics performance. Overall the results suggest that consistent use of digital resources can positively enhance the teaching and learning of Mathematics.

The fourth null hypothesis was:

H_{05}: There is no significant influence of teacher perception on digital literacy on teaching of mathematics in lower primary schools

The regression results indicate a significant positive effect of teachers' perceptions of digital literacy on Mathematics teaching in lower primary schools in Kanduyi Sub-County ($\beta = 0.123$, $p = 0.015$). Since the p-value is below the 0.05 significance level, the fourth null hypothesis was rejected confirming that teachers' perceptions of digital literacy significantly influence Mathematics teaching in lower primary schools in Kanduyi Sub-County, Kenya.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter provides a summary of the study's findings, draws conclusions and offers recommendations on the relationship between teachers' digital literacy skills and Mathematics teaching in public primary schools in Kanduyi Sub-County, Bungoma County, Kenya. It also highlights areas for further research.

5.2 Summary of Findings

The study was carried out in public primary schools in Kanduyi Sub-County involving both teachers and head teachers as respondents. Data were collected using observation checklists, questionnaires and interview guides. The findings showed that learners' performance in Mathematics activities was generally at a moderate level across most schools in the study area. The sections that follow present a summary of the findings based on the study objectives.

5.2.1 Level of Teacher Digital Literacy Skills on Mathematics Teaching

The study established that teachers' digital literacy skills in relation to Mathematics teaching in lower primary schools were generally at a moderate level (M = 3.29), indicating an average level of competence in the use of digital resources for instruction in Kanduyi Sub-County. In particular, teachers demonstrated relatively stronger ability in sharing Mathematics-related information through various digital platforms. However, weaknesses were evident in the use of spreadsheet applications such as Microsoft Excel, which are important for calculations, data organisation and visual representation of mathematical concepts. Overall the ability to conduct fully digital lessons was also found to be moderate across most schools.

Correlation analysis revealed a moderate positive relationship between teachers' digital literacy skills and learners' Mathematics learning activities. The first null hypothesis was therefore rejected ($p < 0.05$) confirming that teacher digital literacy has a significant positive influence on Mathematics teaching in lower primary schools in Kanduyi Sub-County.

5.2.2 Availability of digital literacy devices used on the Teaching of Mathematics

The second objective examined how the availability of digital learning devices influences Mathematics instruction in lower primary schools. Findings from the observation checklist showed that most schools in Kanduyi Sub-County had inadequate or no access to sufficient digital resources. In schools where such resources existed, they were still not enough to support effective learner interaction during Mathematics lessons.

Interviews with teachers and head teachers further revealed that available laptops were mainly used by teachers and school administrators, while government-issued e-readers for lower primary learners were either insufficient, non-functional, or in some cases missing from school stores and as a result, some teachers resorted to using personal smartphones to support classroom activities.

Overall, only 8.2% of schools had adequate digital devices, 58.8% had limited resources and 33.0% had no access at all. Correlation analysis showed a significant positive relationship between availability of digital resources and Mathematics teaching ($p < 0.05$), leading to rejection of the second null hypothesis confirming that availability of digital learning devices has a significant influence on Mathematics instruction in lower primary schools in Kanduyi Sub-County.

5.2.3 Digital device Used in Teaching of Mathematics

The study found that teachers' use of digital devices in Mathematics instruction was occasional, with an overall mean score of 2.82, indicating that integration was neither consistent nor absent. In some instances, teachers logged into platforms such as Google Classroom and YouTube to support learners' participation while at other times they used available e-readers for instructional purposes. This moderate level of use was largely attributed to limited digital skills among teachers, inadequate availability of digital resources in schools and insufficient lesson preparation for integrating technology into Mathematics teaching. It was also noted that mathematical simulation activities were rarely used in classroom instruction.

Despite this, learners whose teachers used digital tools occasionally showed relatively better performance compared to those with minimal use. This relationship was statistically significant ($p < 0.05$), leading to rejection of the third null hypothesis confirming that the use of digital devices has a significant positive influence on Mathematics teaching in lower primary schools in Kanduyi Sub-County, Bungoma County, Kenya.

5.2.4 Perception of teachers on impact of digital literacy and teaching of mathematics activities

The fourth objective examined teachers' perceptions regarding the influence of digital literacy on Mathematics teaching and learning in lower primary schools in Kanduyi Sub-County. The findings showed that teachers generally held positive perceptions with a mean score of 3.86, indicating agreement on the benefits of digital literacy in classroom instruction. In particular, teachers reported that the use of digital learning devices increased learners' interest in Mathematics and made difficult concepts easier to understand. They also observed that digital tools enhanced learners' active participation

during lessons and improved both teacher and learner confidence in the teaching and learning process. Overall these perceptions appeared to encourage the integration of digital tools in Mathematics instruction. The findings further showed that teacher perceptions significantly influenced Mathematics teaching practices, leading to the rejection of the fourth null hypothesis ($p < 0.05$) confirming that teachers' perceptions of digital literacy have a significant positive effect on Mathematics teaching in lower primary schools in Kanduyi Sub-County.

5.3 Conclusions

The study examined how teachers' digital literacy skills influence Mathematics teaching in public lower primary schools in Kanduyi Sub-County. Findings showed that most learners performed at an average level, with few achieving high performance. Results from multiple regression analysis further indicated that 52.8% of the variation in Mathematics teaching was explained by the factors considered in the study.

It was established that most teachers demonstrated only moderate competency in digital literacy with many lacking adequate proficiencies in using electronic spreadsheets such as Excel for mathematical computations thus this limitation hindered their ability to design and deliver digital lessons effectively. Nonetheless the study revealed a significant positive effect of teachers' digital literacy on mathematics instruction where teachers with stronger digital skills recorded higher learner participation and improved performance in mathematics tasks compared to those with lower competency.

The research further found that the availability of digital devices in most public schools was low and despite government policies promoting blended learning, many schools had not invested in acquiring sufficient digital devices due to reduced funding noting that the devices commonly available were e-readers and laptops provided by the government or

donors. Schools with better access to digital devices demonstrated higher learner engagement and achievement in mathematics than those with limited resources.

Overall the use of digital devices in mathematics teaching was moderate across the Sub-County. Limited teacher competency coupled with inadequate resources, constrained their effective use in classrooms. The study therefore concluded that successful integration of digital devices in mathematics teaching depends on both their availability and adequacy however correlation analysis confirmed a significant positive relationship between regular use of digital tools and the teaching and learning of mathematics in lower primary schools. Finally the study noted that despite inadequate digital skills and limited device availability, most teachers expressed positive perceptions of digital technology. They believed that digital tools could enhance learners' understanding of mathematical concepts, increase interest in learning, promote active participation and improve performance in tasks, assignments and examinations.

5.4 Recommendations

Based on the study findings the following recommendations are made for policy and action by relevant stakeholders with the aim of improving teacher digital literacy skills in teaching and learning of mathematics in lower primary schools

(i) There is a need for school management to support teachers' participation in continuous professional development programmes focused on digital literacy, with the aim of enhancing their capacity to effectively integrate digital technologies into classroom instruction. In particular, teachers should be encouraged to undertake structured training in essential computer applications, such as spreadsheets and database management systems, which are critical for facilitating mathematical computations, data organization and analysis. Furthermore, the Ministry of

Education should institutionalize regular digital training seminars for lower primary school teachers to ensure they are adequately equipped with the competencies required to meet the evolving demands of technology-driven teaching and learning environments.

(ii) There is need for the government through the Ministry of Education, Ministry of Energy and Ministry of ICT to ensure that all public primary schools are connected to the national grid (electricity) and internet. Additionally, the government can also construct and equip computer labs in schools to enable teachers to undertake digital learning sessions on various mathematical subject in schools. Schools Board of Management needs also to plan and budget for provision of digital devices. Further they should also device ways of raising funds to purchase additional digital devices through working with parents, former students, request for grants and holding funds mobilisation events to ensure that they upgrade and improve on their digital infrastructure resources to enable integration in teaching and learning process.

(iii) There is need for school head teachers to be at the forefront in ensuring integration of digital lessons in classroom teaching and learning. There is also need for head teachers to schedule weekly digital lessons for various mathematics activities by teachers in lower primary schools and making sure that they are implemented to the latter. The study also recommends that public primary schools need to establish ICT peer learning workshops.

(iv) There is need for teachers to embrace the use of digital devices in teaching and learning process in classroom learning through learning from one another, helping one another and also changing their mind-set towards the use of these digital devices in teaching and learning process.

5.5 Recommendations for Further Research

The study makes the following suggestions for future research with respect to teachers' digital skills in conducting classroom instructions in schools

(i) A similar research can be conducted within junior secondary schools to establish how teachers have integrated digital lessons in teaching and learning of mathematics subjects in schools.

(ii) A similar research can be conducted to determine head teachers level of digital training skills in promotion of learning activities in their schools

(iii) A similar research can be undertaken through experimental study to determine existence of difference between learners taught using digital resources and those who have not been taught using digital devices and academic performance in mathematics activities.

(iv) Future studies should examine ICT integration in private schools and compare rural vs urban contexts

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APPENDICES

Appendix A: Letter of Introduction

Lilian Akello Karakacha
University of eldoret
P.O BOX 1125-30100
Eldoret

TO THE HEAD TEACHER,
----------PRIMARY SCHOOL,

P.O. BOX ----------

Dear Sir / Madam,

RE: RESEARCH STUDY

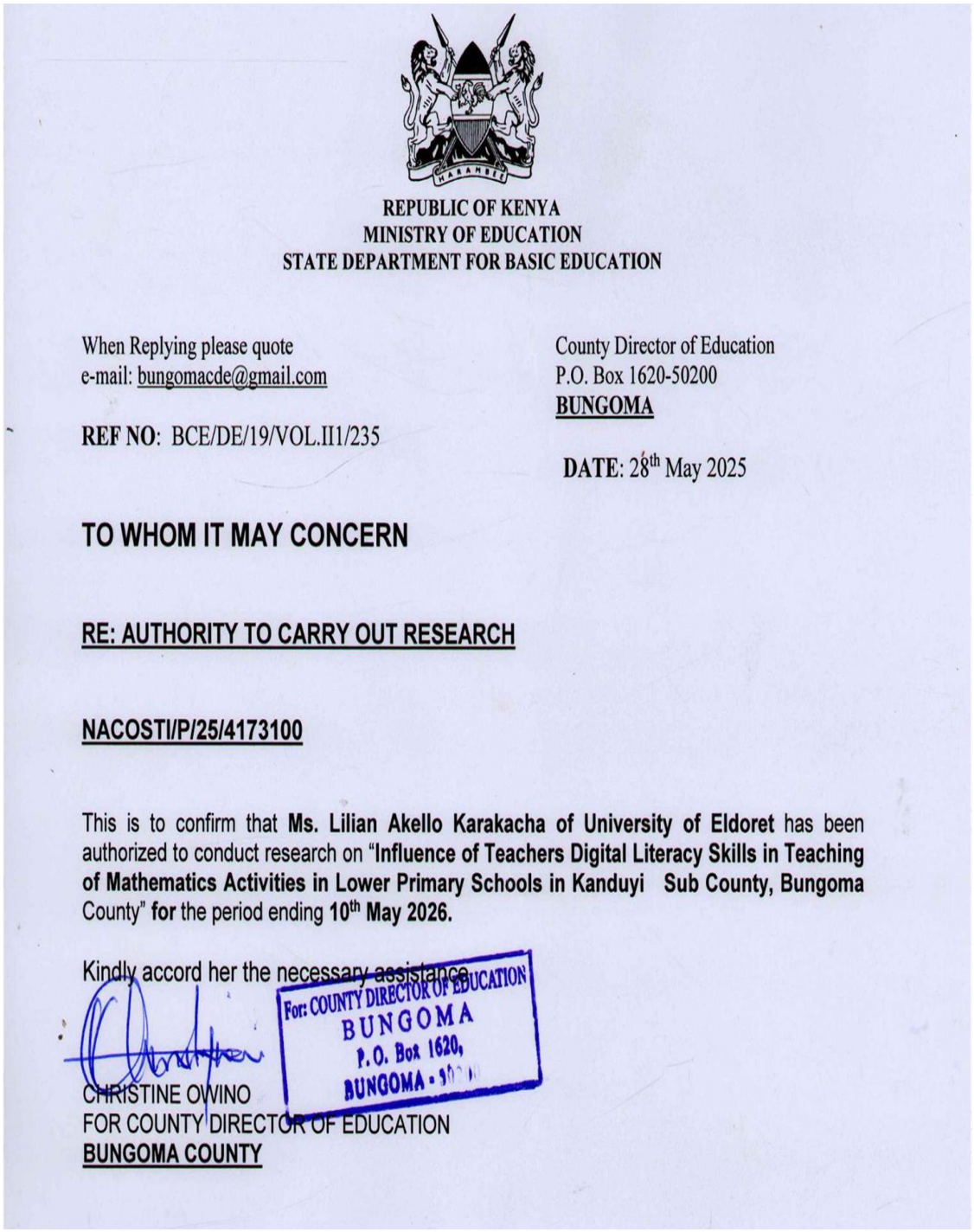
I am a student at the University of Eldoret undertaking a Master Degree in Early childhood and Primary Education. Am conducting a research study on, "Influence of teachers' Digital Literacy Skills on the Teaching of Mathematics in Lower Primary Schools in Bungoma South Sub-County, Bungoma County". I will greatly appreciate your assistance in answering the following questions. Your contribution will be treated with utmost confidentiality and will be used solely for the purpose of this study.

Thank you in advance,

Yours faithfully,

Lilian Akello Karakacha

Appendix B: Permission Letter from the Ministry of Education (County Director)



REPUBLIC OF KENYA
MINISTRY OF EDUCATION
STATE DEPARTMENT FOR BASIC EDUCATION

When Replying please quote
e-mail: bungomacde@gmail.com

County Director of Education
P.O. Box 1620-50200
BUNGOMA

REF NO: BCE/DE/19/VOL.II1/235

DATE: 28th May 2025

TO WHOM IT MAY CONCERN

RE: AUTHORITY TO CARRY OUT RESEARCH

NACOSTI/P/25/4173100

This is to confirm that **Ms. Lilian Akello Karakacha of University of Eldoret** has been authorized to conduct research on "**Influence of Teachers Digital Literacy Skills in Teaching of Mathematics Activities in Lower Primary Schools in Kanduyi Sub County, Bungoma** County" **for** the period ending **10th May 2026.**

Kindly accord her the necessary assistance.

For: COUNTY DIRECTOR OF EDUCATION
BUNGOMA
P.O. Box 1620,
BUNGOMA

CHRISTINE OWINO
FOR COUNTY DIRECTOR OF EDUCATION
BUNGOMA COUNTY

Appendix C: Permission Letter from the School of Education

University of Eldoret
flame of knowledge and innovation

P.O. Box 1125-30100, ELDORET, Kenya
Tel: 053-2063111/3 Ext.2032
Fax No. 20-2141257
Email: soe@uoeld.co.ke
www.uoeld.ac.ke

UNIVERSITY OF ELDORET

SCHOOL OF EDUCATION
CURRICULUM AND INSTRUCTION

Ref: UOE/B/CIM/RP/122 **Date:** 10TH April , 2025

The Executive Secretary,
National Council for Science and Technology,
P.O. Box 30623-00100,
NAIROBI.

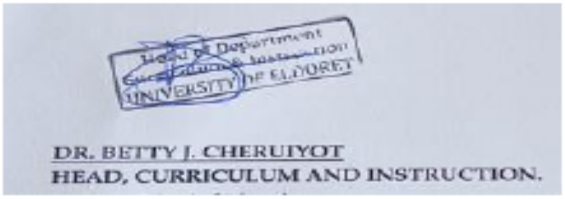
Dear Sir/Madam,

SUBJECT: **RESEARCH PERMIT FOR: LILIAN AKELLO KARAKACHA**
REG NO: SEDU/CIM/M/010/17

This is to confirm that the above-named Post Graduate Student has completed Course Work and has successfully defended his thesis proposal.

He is currently preparing for a Field Research Work on her thesis entitled: ***INFLUENCE OF TEACHERS' DIGITAL LITERACY SKILLS IN TEACHING OF MATHEMATICS ACTIVITIES IN LOWER PRIMARY SCHOOLS IN KANDUYI SUB COUNTY, BUNGOMA COUNTY***
Any assistance accorded to him to facilitate successful conduct of the research will be highly appreciated.

Yours Faithfully,



DR. BETTY J. CHERUIYOT
HEAD, CURRICULUM AND INSTRUCTION.

Appendix D: Research Permit from NACOSTI

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: 916274

Date of Issue: 10/May/2025

RESEARCH LICENSE

This is to Certify that Ms.. LILIAN AKELLO KARAKACHA of University of Eldoret, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Bungoma on the topic: INFLUENCE OF TEACHERS' DIGITAL LITERACY SKILLS IN TEACHING OF AMATHEMATICS ACTIVITIES IN LOWER PRIMARY SCHOOLS IN KANDUYI SUB-COUNTY for the period ending : 10/May/2026.

License No: NACOSTI/P/25/4173100

916274

Applicant Identification Number

Deputy Director
NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Verification QR Code

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See overleaf for conditions

Appendix E: Questionnaire for the Teachers

Instructions: *Do not write your name or name your institution in the Questionnaire. Please answer with a tick or essay.*

Section A: General Information

1. What is your gender?
   Male [ ] Female [ ]
2. What is your highest level of Education?
   Certificate (P1) [ ] Diploma [ ] Bachelors' Degree [ ]
   Postgraduate Diploma [ ] Masters [ ]
3. What is your age bracket?
   20 – 30yrs [ ] 31 – 40yrs [ ] 41 – 50yrs [ ]51yrs & above [ ]
4. How long have you been in the teaching profession?
   2 yrs & below [ ] 3 – 5yrs [ ] 6 – 10yrs [ ] 11 – 15 yrs
   16yrs and above [ ]

Section B: Teachers Digital Skills

This section seeks your views with respect to digital literacy skills and application in classroom instruction.

Part I: Teachers Level of Digital Literacy Skills

5. (a) Kindly rate your level of literature with respect to statements provided in this table.

	Competency area	Very low	Low	Moderate	High	Very high
1	Handling digital tools					
2	Assessing digital information					
3	Ability to use spreadsheets / data base applications					
4	Finding mathematical information through search engines					
5	Creating new information through digital devices					
6	Sharing information through digital devices					
7	Creating and conducting in digital classes					

(b) What can you comment on the significance of teacher digital literacy skills / competencies on your classroom instruction in the present digital world?

……

…….

Part II: Availability of Digital Devices in Schools

6. (a) Kindly indicate whether the following digital devices are available, adequate or unavailable in your school

	Digital devices	**Available**		**Unavailable**	**Comments**
		Adequate	**Inadequate**		
1	Calculator				
2	Computer game programs				
3	E – readers / tablet				
4	Smart phones				
5	Smart boards				
6	Smart TVs				
7	Projectors				
8	Geoboard Making				
9	Wall clock				
10	Digital camera				

(b) Which other digital devices are present in your school?

……

…….

Part III: Extent of Digital Device Use in Classroom Instruction

7. (a) Indicate the frequency to which you apply various digital devices in conducting teaching and learning activities in your school on the statements provided in the following scale

	Integration area	**Never**	**Rarely**	**Sometimes**	**Often**	**Always**
1	Learning online through google classes, YouTube among others					
2	Using PowerPoint and projector					
3	Online math games					
4	Digital mathematical simulation and models					
5	Graphics and animation					
6	Online math quizzes and games					
7	Utilising e-books and e-notes on mathematics activities					

(b) How else do you utilise digital devices in classroom instruction in your school?

……

…….

Part IV: Teacher perception on the effect of digital literacy skills on classroom instruction

8. (a) Indicate the extent to which you agree or disagree with the following statements on effect of digital literacy skills on teaching and learning of mathematics subject in your school

	Perceptions	**Strongly disagree**	**Disagree**	**Undecided**	**Agree**	**Strongly Agree**
1	Use of digital devices has enhanced basic mathematic operations					
2	Use of digital devices makes mathematics learning simple and easier/easy understanding					
3	Use of digital devices helps to improve pupils' learning/identification of mathematics learning abilities					
4	Use of digital devices ensures participation of pupils in learning process					
5	Use of digital devices help pupils to get a pictorial representation of mathematical concepts					
6	Use of digital devices reduces teacher too much talking in lesson delivery					
7	Integration of digital devices eensures child-centeredness in teaching					
8	Use of digital devices enhances syllabus coverage					
9	Use of digital devices improves presentation of materials for mathematics lesson					
10	Use of digital devices in mathematics teaching increases my confidence					

(b) What are your views on the effect of digital device use on teaching and learning of mathematics activities in school?
……
…….

Section C: Mathematics Learning Activities

9. Indicate the level and achievement of learners in your class with respect to mathematics teaching on the statements provided in the table below.

	Mathematics activities	**Very low**	**Low**	**Moderate**	**High**	**Very high**
1	Pupils working out mathematical problems					
2	Pupils interest in mathematics learning					
3	Pupils performance / scores in mathematics tasks					
4	Pupils' application of mathematical knowledge					
5	Counting & measuring using digital devices					
6	Ability to use digital devices to draw or sketch mathematical symbols					

The End.
Thank you

Appendix F: Interview Schedule

Introduction

This interview seeks your views with respect to the relationship between teachers' digital skills and teaching and learning of mathematics activities in lower primary schools.

Questions

1. How would you rate the current level of digital literacy among lower primary school teachers in your primary school?
1. What are some of the initiatives that your institution has undertaken to promote teacher digital literacy skills in your school?
2. What are the digital devices / technologies present in your school? To probe further on their adequacy, condition / status
3. Who normally utilise digital devices in school learning? To probe on whether it is both learners and teachers or teachers themselves
4. How often does your primary school ensure integration of digital technologies devices in teaching mathematics activities in lower primary schools?
5. To what extent does your teachers integrate digital technologies in teaching mathematics activities in lower primary schools in your Primary School?
6. What do you view on the contributions of digital literacy skills by teachers towards mathematics activities instructions in lower primary school?
7. What are some of the challenges associated with teacher digital literacy skills and mathematics teaching in your school?
8. How can the above-mentioned challenges be resolved to ensure effective integration of digital infrastructure devices in teaching and learning of mathematics activities in lower primary schools?

Appendix G: Observation Checklist

	Digital device / infrastructure	**Available**		**Unavailable**	**Condition / status of use / comments**
		Adequate	**Inadequate**		
1	Laptops				
2	Desktops				
3	Internet				
4	ICT laboratory				
5	E – readers / tablet				
6	Smart phones				
7	Smart boards				
8	Smart TVs				
9	Projectors				
10	Printers				
11	Scanners				
12	Photocopiers				
13	CD/DVDs				
14	Audio visual devices				
15					
16					
17					
18					
19					
20					

Researcher's additional comments on what was observed

……
……
……
……

Appendix H: Similarity Report

DrillBit

The Report is Generated by DrillBit Plagiarism Detection Software

Submission Information

Author Name	LILIAN AKELLO KARAKACHA REG.NO: SEDU/CIM/M/010/17
Title	INFLUENCE OF TEACHERS' DIGITAL LITERACY SKILLS ON THE TEACHING OF MATHEMATICS IN LOWER PRIMARY SCHOOLS IN KANDUYI SUB-COUNTY, BUNGOMA COUNTY, KENYA
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Result Information

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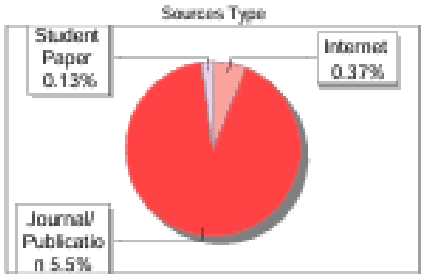

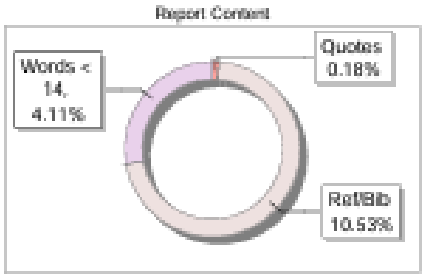

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