TEACHERS' INTEGRATION OF TECHNOLOGY IN TEACHING OF MATHEMATICS ACTIVITIES IN EARLY YEARS EDUCATION IN BUNGOMA COUNTY, KENYA

BY

VIOLET MUYOKA WANGILA

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DECLARATION

Declaration by the Candidate

I certify that this thesis is wholly my own original work and has not been presented in whole or in part for another degree elsewhere, with the exception of quotations and references from existing publications that have all been recognised and properly acknowledged. Without the author's or Moi University's permission, this cannot be copied in whole or in part.

Signature……. Date: …….

Violet Muyoka Wangila

MPECT/5990/22

DECLARATION BY SUPERVISORS

This research thesis has been submitted with my approval as the university supervisor.

Signature……. Date: …….

Prof. Alice Yungungu

Department of Curriculum, Instruction and Educational Media,

School of Education,

Moi University.

Signature……. Date: …….

Dr. Robert Masinde

Department of Curriculum, Instruction and Educational Media,

School of Education,

Moi University

DEDICATION

This work is lovingly dedicated to my family: my spouse Sylvester Wangila, my daughter Sharon and my sons Brian and Bramuel, whose unwavering support and encouragement have been my greatest source of strength. To my two wonderful grandchildren, “Prof.” Wambui Wanjohi and “Eng.” Muyoka Wanjohi, may you always reach for the stars and pursue knowledge without limits. The sky is truly the beginning of your journey in the world of academia.

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ABSTRACT

Effective integration of technology in early childhood education enhances learning, motivates learners, and promotes practical understanding. However, many African countries, including Kenya, face challenges in implementing technology in classrooms. This study investigated the integration of technology in teaching mathematics activities in Early Years Education (EYE) in Bungoma County. The objectives were to assess teachers' competence, attitudes, extent of technology use, and teaching methods when integrating technology into mathematics instruction. The study was guided by Mishra and Koehler's Technological Pedagogical Content Knowledge (TPACK) framework and adopted a pragmatic paradigm with a mixed-methods, convergent design. The target population comprised 2,652 participants from 884 public primary schools. A sample of 265 respondents included 177 teachers of EYE selected through simple random sampling and 88 head teachers selected through purposive sampling. Data was collected using questionnaires for teachers of EYE and head teacher interviews. Quantitative data was analysed using descriptive statistics, while qualitative data were thematically analysed and presented narratively. Findings revealed that most EYE teachers possessed basic technological skills and effectively used tools such as interactive whiteboards and online resources in mathematics instruction. Head teachers confirmed teachers' competence in using digital tools, though a few teachers reported limited skills. The majority exhibited positive attitudes toward technology, noting that it enhanced learner interaction, creativity, and visualisation. Nonetheless, a small number held negative attitudes. Teachers reported adequate access to digital devices such as tablets and interactive whiteboards, and commonly used videos, animations, and scaffolding techniques. Challenges included poor internet and electricity connectivity, which hindered effective technology integration. The study recommends that school management and parents allocate funds for teacher training and attitude sensitisation on technology use. Collaboration with county governments to install solar panels is also advised to improve power access. The findings will inform education stakeholders on strategies for strengthening technology integration in early childhood education

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ABBREVIATIONS AND ACRONYMS

ADHD:	Attention Deficit Hyperactivity Disorder
ECDE:	Early Childhood Development Education
ECDC:	Early Childhood Development Centre
EYE:	Early Years Education
GBL:	Game-Based Learning
ICT	Information Communication Technology
IT:	Information Technology
NACOSTI:	National Commission for Science, Technology and Innovation
NAEYC:	National Association for the Education of Young Children
NEPAD:	New Partnership for Africa's Development
OECD:	Organisation for Economic Cooperation and Development
PBS:	Public Broadcasting Service
SMASSE:	Strengthening of Mathematics and Science in Secondary Education
SSD:	Speech Sound Disorders
STEM:	Science, Technology, Engineering, and Mathematics
TPACK:	Technological Pedagogical Content Knowledge
UNESCO:	United Nations Educational, Scientific and Cultural Organisation

CHAPTER ONE

INTRODUCTION TO THE STUDY

1.1 Introduction

Kenya's economic plan, Vision 2030, is focused on a knowledge-based economy, with ICT-the term used in this research to refer to computers, serving as the primary driver in all sectors, including education. To achieve the aim, a variety of educational initiatives have been implemented, including making computer studies a learning area in the new Competency Based Curriculum so as to enable develop the 21st Century competencies among learners. Others include, but not limited to the primary school laptop project, New Partnership for Africa's Development (NEPAD) model school projects, and teacher inset programs like Strengthening of Mathematics and Science in Secondary Education (SMASSE). ICT is thought to be a strong and enabling instrument that might bring about the much-needed educational transformation and reform in Kenya taking cognizance of the tenets of the Competency Based Curriculum (CBC). Key among these tenets is the need to ensure that learners are provided with Learning Experiences that call for higher order thinking, thereby ensuring that they become engaged, empowered and ethical citizens as anticipated in the Basic Education Curriculum Framework (BECF) vision, (KICD, 2017). Students' need for ICT is likely driven by their perceptions of their future careers and peer pressure since it is considered that using digital technology in teaching and information sourcing offers learners an advantage in academic achievement and the job market (Delen & Bulut 2011). Therefore, this chapter looks at integration of technology in mathematics curriculum and its implication to classroom teaching in Early Years Education in Kenya. The parts that will be looked at include; the background of the study, statement of the problem, purpose of the study, the research objectives, research questions and justification of the

study. Further the study will also look at the significance of the study, scope of the study, limitations of the study and assumptions of the study. Lastly the study will also discuss the theoretical framework, its conceptual framework, and the operational definitions of terms and give summary of the chapter.

1.2 Background of the Study

A knowledge-based economy has emerged in the 21st century as a result of globalization and the fast advancement of technology. In order to provide students with the skills they will need for modern life and beyond, governments have invested in integrating ICT into education at all levels (Wambiri & Ndani, 2016). In certain nations, such as South Korea, where unprecedented economic development has been witnessed since the 1970s, the inclusion and significant investment in educational technology are thought to have had a beneficial impact (Sanchez et al., 2011). Additionally, Kozma (2003) asserts that other nations, including the Netherlands, Taiwan, Norway, Finland, and Singapore, have implemented educational reforms to keep up with global developments in a cross-national comparative study of technology and classroom practices encompassing 28 states.

According to the survey, educational changes in these nations concentrated on what pupils already knew and gave interpersonal skills and ICT training more of a priority. Numerous studies have also documented the advantages using technology in education has for both instructors and students in a variety of settings, including underdeveloped nations. For instance, Lee and Scott, (2022), summarized their argument in favor of the use of technology in education by saying that youngsters are drawn to various voices and noises, which leads to cognitive processes that produce meaning. According to Aktaruzzaman et al., (2011), ICT may improve education in a number of ways,

including increasing access to it, making it more relevant, and raising the standard of instruction since it makes teaching and learning an active activity.

In order to help students understand and reason exactly, rationally, and critically in given scenarios that may be known or new, mathematics plays a significant role in the academic world and in any educational system (KICD, 2022). The widespread lack of proficiency in the subject has made ICT integration in mathematics necessary (Githua, 2013). Lower arithmetic scores in exams are of great concern to parents, educators, and all other stakeholders involved.

Saturation of digital technologies particularly smart phones, laptops and computers has been found to improve social interaction. Cherney and Dempsey (2010), found an increase in interaction when children worked in pairs at a computer than when playing with puzzles on the floor. When exposed to appropriate technologies, children become better collaborators which promote peer learning as they assist each other on how to use computing devises to perform learning tasks. In addition, they are likely to become independent in learning and are more likely to grow into autonomous and successful technology users. In support of this contention, Yelland (2010), opined that digital technology instruction aids learning predominantly mathematical skills, implying that sorting activities could be just as easy through use of computers as with use of concrete materials. In this regard, adequate access to technology may provide basic skills in which children acquire competency in order to be successful in school and develop skills critical for high order thinking.

Analysis by Zitter and Hoeve (2011), illustrated that digital technologies make it possible for children to experience virtual tours and opportunities in viewing situations in real world which they might not have a chance of viewing. Hence, in instances where

EYE teachers adopt appropriate technologies into pedagogical management, children experience increased motivation, improved collaboration and knowledge construction which in turn lead to enhanced class practices. However, despite continuing enthusiasm for technologies in modern world, teachers in EYE have limited access likely due to inadequate didactical curriculum competence. Additionally, Fu, (2013), observed that inadequate access to digital technology in early childhood settings is due to a resistance within the field of wider community, who see the tool as neither appropriate nor important. In order to effectively guide instruction using digital technology, teachers in EYE need to re-conceptualize pedagogy and learning opportunities for learners in the digital world to experience equal opportunities for learning.

Additional study by Nikolopoulou, et Al, (2010) in Greece showed that children in the age bracket of 4-6 access a wide range of technologies at home. While digital technology has high profile in EYE environments, teachers should ensure equity and access in order to address divide between pre-school children who come with a wealth of experience with technology and those who come from technology poor backgrounds. According to Banas (2010), quality learning environments are critical in planning and implementation of digital technology in order to address gaps in teacher perception, confidence, training and conflicting professional views on whether technology acts as a tool in learning. To achieve this, EYE settings should increase learner engagement with new technology by supporting teachers' training in appropriate use of skills in digital technology, disseminating appropriate software to pre-schools as well as replacing traditional class settings with flexible learning centers accessible to digital technology. While there is considerable support for digital technology for enabling learning, it should be within quality pedagogical framework and access by pre-school teachers.

In order to change its curriculum, Rwanda switched from a teacher-centered to a learner-centered approach in 2015. Teachers now digitally encourage their students to actively learn and develop their own knowledge, skills and appropriate attitude. Less lecturing and more interactive teaching strategies are anticipated to rule the classroom activities with this learning strategy (Ndihokubwayo & Habiyaremye, 2018). In order to facilitate the successful implementation of the new Competency-Based Curriculum (CBC), which has been under implementation in Rwanda since 2015, ICT use in teaching and learning activities was given priority. In reality, the development of newer technologies resulted in a number of pedagogical advantages, including the elimination of the worry about teachers being stationary in front of classrooms and the encouragement of more engagement and interactivity in a learner-centered learning environment. In order to move away from the conventional position of the teacher as a "sage on the stage," which encourages passive learning and lower levels of student participation, it is crucial to integrate ICT in classroom activities. When ICT is used as a teaching tool, instructors are free to walk around the classroom monitoring students' learning progress and activities while also attending to their needs.

Kenya is not exceptional, like the rest of the world, it has made strides through MOEST by recognizing the role of ICT in education. National ICT policy in Kenya emphasizes its integration to improve access, learning and administration, to establish a policy framework, install digital equipment, connectivity and networking. The Ministry of Education (MoE) admits that ICT in education is the natural platform for equipping its citizens with skills for dynamic and sustainable economic growth and failure to integrate ICT, the country risks serious global marginalization (MOEST, 2006). For this reason, Sessional Paper No. 1 of 2005, articulates strategies to address the challenges of ICT in education. These strategies include mobilization of resources,

digitalization of curriculum by Kenya Education Sector Support Programme (KESSP) and identification of pilot schools equipping teachers with the necessary skills. Sessional paper No.14 of 2012, points out that ICT strategies were put in place in 2006, with the aim to modernize Kenya's education system and expand access, training and research by working towards developing new models, develop ICT curriculum and incorporate necessary standards, practices and regulations. Institutions working in ICT for education at the ministry of education in Kenya include; ICT for education department, ICT integration committee, National ICT integration and innovation center, Kenya Institute of Curriculum Development (KICD) and Center for Mathematics, Science and Technology in East Africa, (CEMASTEA) launched the e-learning content which the Compact Disc (CD) for Read-only-memory (ROM) and Digital Versatile Disc (DVD) are produced for schools (KICD, 2010). Despite all these initiatives, Gakuu (2010) posits that ICT integration is commonly embedded in private schools unlike in the public schools with a view to attract students in these schools to improve performance.

Despite the developments, formal education in most countries has been slow to adopt technological innovations, notwithstanding decades of inefficiency in education. For instance, educators in Kenya, as in other countries, have been concerned with students' performance, low motivation and negative attitude towards mathematics, attributed partly to curriculum that appears irrelevant to most learners (Ogwel, 2008). Ironically, students' poor performance contrasts sharply with skills they acquire out of school in ICT environments. Envisaged reforms in mathematics education advocate for use of authentic tasks that engage students and promote development of problem-solving skills; and linking instruction to everyday life. In addition, there is an envisaged shift in instruction from teacher-centered to student-centered practices with enhanced focus

on collaborative and cooperative learning. The proposed reform vision may be achieved within an ICT integrated curriculum, which would also provoke deeper mathematical reasoning. However, a number of challenges have to be overcome before digital technologies can be effectively integrated in mathematics education. These include curriculum coherence, inappropriate pedagogical practices, inadequate teacher preparation and professional development, and lack of appropriate infrastructure.

Digital literacy is one of the essential characteristics for Kenya's Competency Based Curriculum (CBC), according to KICD (2023). Communication and teamwork, critical thinking and problem solving, creativity and imagination, citizenship, learning to learn, and self-efficacy are the other essential skills. Application of digital literacy is also for learning and enjoyment which is one of the objectives of EYE learning outcomes. Other key learning outcomes are demonstration of basic literacy and numeracy skills, application of critical thinking skill in problem solving, practicing etiquette and interpersonal relationships. This has been well elaborated in figure 1.1 and 1.2 below. The figures clearly indicate the competencies in the Basic Education Curriculum Framework and the seven core competencies to be achieved by every learner in basic education respectively.

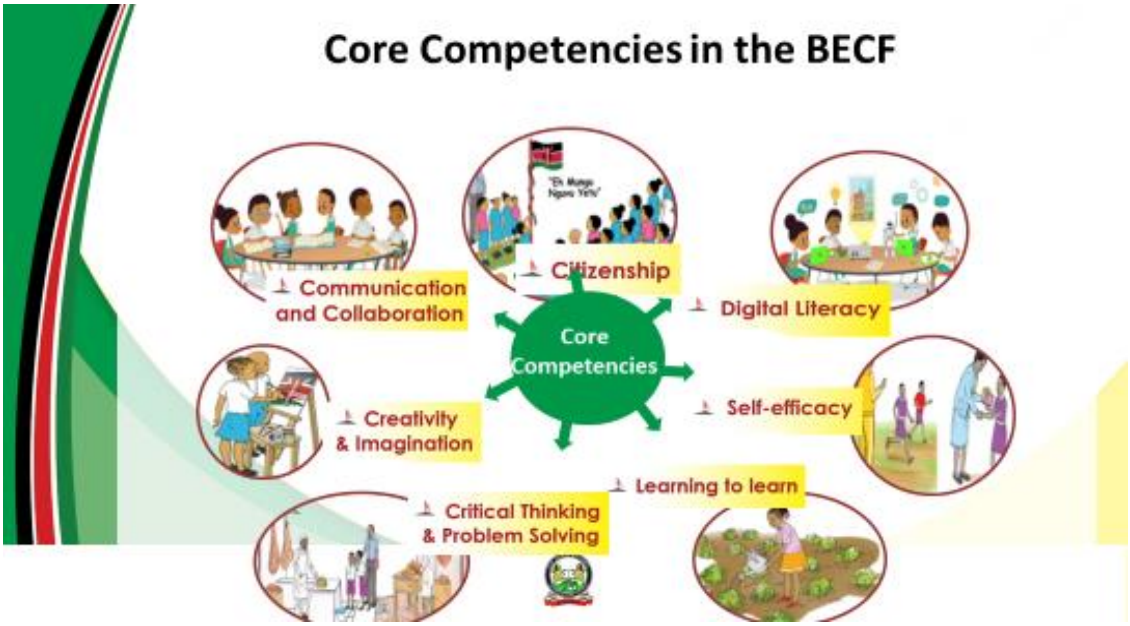

Figure 1.1 BECF Core Competencies

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Figure 1.2 The Seven Core Competencies in CBC

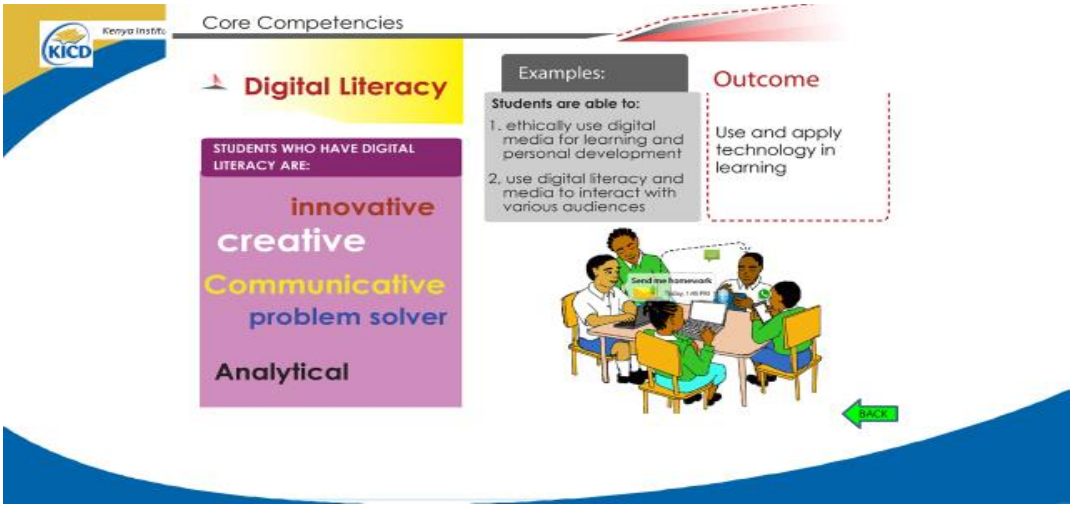

Figure 1.3 Impacts of Technology to Learners

Figure 1.3 above has outlined some of the effects of the use technology to learning. According to KICD (2023), students who have digital knowledge are innovative, communicative, problem solvers and analytical. These students are able to ethically use digital media for learning and personal development, interact with various audiences finally they are able to use and apply technology in learning.

1.3 Statement of the Problem

ICT not only facilitates teachers in their teaching practice but also plays a key role in enhancing students' learning (Munyengabe *et al.*, 2017). It can afford to monitor students' learning through regular assessments, which inform teachers about students' progress to make the appropriate decisions in improving the teaching and learning process (Golzar *et al.*, 2022). Further, ICT helps students to make self-reflection about their learning progress. Furthermore, ICT contributes to strengthening teacher professional development and improving the quality of education (Ministry of Education, 2016). In mathematics, ICT enables students to make calculations, draw graphs, and solve problems. Jalinus and Alim (2019) argued that teaching mathematics to elementary kids using ICT is important since it enhances students' creativity, active

learning, and independent learning. Using ICT tools in teaching mathematics therefore is expected to improve the quality of teaching.

Kenya like other Sub-Saharan African countries has over the years embedded ICT in its education policies (Mariga, 2017; Muinde & Mbataru, 2019). The Kenya National Education Sector Plan 2013–2018 placed a strong emphasis on ICT integration in education, despite the paucity of empirical studies demonstrating the influence of ICT in improving learning in the nation (Piper & Zuilkowski, 2015). In order to increase the provision of effective, reasonably priced, and dependable technology services across all economic sectors, this strategy adhered to the National ICT policy, which was passed in 2006. All first-graders in "selected" public primary schools in Kenya now have tablets thanks to the value and recognition of ICT in education in accomplishing the country's development roadmap, "Vision 2030" (Mariga, 2017; Muinde & Mbataru, 2019). Following this, curriculum changes were made to give all students in the nation the basic competencies and cutting-edge digital literacy abilities they would need to compete in the twenty-first century (Maluei, 2019).

Appropriate use of technology in early childhood settings reinforces learning, motivates learners and makes learning real. While proliferation of digital technology continues advancing globally, African countries, including Kenya, continue experiencing a gap in integrating technology in the teaching/learning process. Abel *et. al* (2022) assert that technology integration in teaching is still in its early phases due to inadequacy of qualified teachers in ICT as well as poor perception by teachers. Though technology has become a day to day element in modern society embracing many aspects of daily lives including social interactions, little is known about teacher preparedness in integrating technology in the teaching of Mathematics in Kenya. It is in this regard that

the current study investigates the teachers' integration of technology in the teaching of mathematics in EYE in Bungoma County.

1.4 Purpose of the Study

The purpose of this study was to investigate Teachers' integration of technology in teaching Mathematics in EYE in Bungoma County, Kenya.

1.5 Research Objectives

The study was guided by the following objectives; -

i. To assess teachers' competency in the use of technology in teaching mathematics activities in EYE;
ii. To determine teachers' attitude towards the use of technology in teaching mathematics activities in Early Years Education;
iii. To establish how adequately technology is used in teaching mathematics activities in EYE;
iv. To establish teachers' teaching methods in teaching mathematics activities in EYE using technology.

1.6 Research Questions

The study was guided by the following research questions; -

i. What is the level of teachers' competence in integrating technology when teaching mathematics in EYE?
ii. What is the teachers' attitude towards the use of technology in teaching mathematics activities in Early Years Education?
iii. To what extent is technology adequately used in teaching mathematics activities in EYE?

iv. Which teaching methods do teachers employ when integrating technology in teaching mathematics activities in EYE?

1.7 Justification of the Study

As had formerly been renowned, there had been a public uproar over the poor achievement in mathematics at all levels of the education system universally and in Kenya (Ipapa, 2020). Although, Education studies on the methods of teaching of mathematics at higher levels in Kenya had been acknowledged and results of the findings and approvals alluded to, this had not enhanced results as far as achievement was concerned. This made the study to advocate that researches should be hard-pressed way down to ECDE level, more so on teaching methods which had been cited as one of the contributing factors for the minimal achievement. This was especially significant when research in other countries of the world indicated that high quality, demanding and accessible mathematics education for 3-8 years old children was a crucial foundation for future mathematics skills at higher levels of leaning, (Ipapa, 2020).

Early Childhood Education was part of the basic education undertaken by the Kenyan government aimed at laying a good foundation not only for the children at the level, but for the entire education system. Research in childhood development had verified that experiences gained in early childhood influence cognitive and social skills at higher levels of education. This then means that improving mathematics achievement at the E.C.D.E, level should improve mathematics skills at higher levels. Some of the habits of improving this foundation level were through use of interactive teaching methods in place of non-interactive teaching methods. The use of non- interactive methods had failed effectively to communicate the mathematical concepts to learners. According to research, kids who use technology that is developmentally appropriate strengthen their social skills, their cognitive memory and fine motor skills, their communication skills,

and their participation in the teaching and practice of reading and math. Students may use technology to study, grow, and become proficient digital consumers and creators in the twenty-first century (Sharkins et al., 2016).

Despite the fact that several studies have examined and assessed the use of technology in education, (Johnson, 2016; Alam, 2022; Karanja, 2023), very few of them have specifically focused on the use of technology in early learning. This project increases teaching and learning technological approaches by incorporating new technology tactics that may be used by institutions of early learning and then further examined by academics and researchers. This research focused on filling the gaps in the practical literature relating to challenges and strategies for integrating technology into education and learning since most literature only offers theoretical justifications for doing so and there aren't enough primary studies or pedagogical perspectives.

1.8 Significance of the Study

The study on the integration of technology in mathematics curriculum and its implication to classroom instruction in Early Years Education is significant because of a number of reasons. First and foremost, this study is valid as it is hoped that the findings of the study will benefit early learning institutions management, learners, policymakers, governments, scholars, researchers and other relevant stakeholders. This study aims at educating the institutions of early learning about how important the integration of technology is in teaching and learning mathematics activities in Early Years Education. It will also help in finding out the techniques that can strengthen teaching and learning mathematics activities in EYE by the use of technology.

Secondly, this research assists institutions of early learning by researching learners' most widely used methods in technology, as well as the most effective ways and techniques to attract and interact with future foreign learners.

This study also aims at proposing successful ways and incorporation of information communication and technology in teaching and learning which can boost the academic achievement of learners in mathematics activities. It is not enough for early learning institutions to merely establish a link with their prospective learners; it is also necessary to attract their interest and engagement and to create a constructive link. It is also important to understand that early years of a child are a very crucial stage for cognitive development. This is a time when children's brains are elastic and can easily acclimatize to new ways of learning. When the technological devices such as tablets, educational hardware and interactive games are used, learners are provided with an opportunity to enhance the learning outcomes and develop positive attitudes.

The world over has advanced technologically. There is therefore need for digital literacy in all aspects. Mathematics activities being part of the crucial aspects in EYE. Early years learners need the digital skills to compete favorably in the technologically advanced world. The use of the technology in mathematics activities can improve the learner's competency which can support the current and future workforce demands.

Further, this study benefit learners in terms of informing them on effective usage of technology in learning that can enhance their academic achievement. Learners in early learning institutions come from diverse backgrounds. Apart from relying on traditional communication sources, or even travelling from one place to the other, they can rely on Technology for academic and other related information.

Last but not least, this study on the integration of technology in teaching and learning mathematics activities in EYE is vital since it helps in providing guidelines for educators to incorporate technology effectively in early year's education to improve learning outcomes. The researchers, policymakers and educators can promote effective technology integration in early years learning which can contribute to the development of the educational curriculum to make decisions on whether to recognize the integration of technology in teaching and learning which can be introduced in the curriculum.

1.9 Scope of the Study

The scope of this study refers to the parameters under which the study was carried out. The study was carried out in Bungoma County. The main aim of this study was to determine the integration of technology in mathematics curriculum and its implication to classroom instruction in Early Years Education in Kenya. The study restricted itself to assess teachers' competency in the use of technology in teaching mathematics activities in EYE; determine teachers' attitude towards the use of technology in teaching mathematics activities in Early Years Education; establish how adequately technology is used in teaching mathematics activities in EYE and establish teachers' teaching methods in teaching mathematics activities in EYE using technology. The study was conducted among teachers and head teachers of early learning centers in Bungoma County Kenya who were randomly and purposively selected. The study used cluster sampling and simple random sampling to arrive at the sample size of 177 teachers of EYE while purposive sampling was used to select head teachers. The data collection instruments were questionnaires for teachers of EYE, and interview schedules for the head teachers, and an observation checklist. Quantitative data was analyzed using descriptive statistics, such as means, frequencies, and percentages while

Qualitative data was analyzed using content analysis procedures before being presented thematically in accordance with the study's objectives.

1.10 Limitations of the Study

Limitations are aspects of the study that may negatively influence results and have an impact on the generalizability of the results, which the researcher may or may not definitely have control over (Mugenda & Mugenda, 2003). It is important to understand that there is no single study without limitations. The study on determining the integration of technology in mathematics curriculum and its implication to classroom instruction in Early Years Education in Kenya had its own share of limitations.

The study sample size seemed limited. This was due to a big number of institutions of early learning. It proved to be difficult for each institution to be selected and thus a small number was settled on. Hensley et al., (2017) found out that smaller sample sizes can hinder the accuracy of the results. However the limitation was alleviated by ensuring the best sampling technique is used at the initial stage to avoid biasness. In this case, simple random sampling technique was used in terms of selection of the institution. The simple random sampling ensured that each institution had an equal opportunity to be selected. On the other hand, stratified sampling was used to put the institutions in strata of the schools that use technology and those without technology. This was through prior knowledge that the researcher had on the types of schools in the County. This kind of knowledge helped the researcher to avoid haphazard way of selecting schools which could to be difficult to get the much-required outcomes.

Further, there was going to be a problem in the generalizability of the results due to the fact that the sample population was from the same County. This could make the statistical significance of collected data biased in nature. However, this was evaded by

incorporating the simple random sampling technique at the initial sampling stage hence making sure that the sample selected is representative of the entire population

Validity and Reliability of the tools of data collection could have posed a problem in the accuracy of the expected results. The limitation in this case was evaded by the use of the test-retest method. The tools of data collection were given to the pilot group for more than once just to ascertain if they could yield the same results. The consistency of the results during piloting showed the credibility of the tools which were later on used to collect data. The researcher also brought in the aspect of triangulation of the research instruments. In this case the researcher did not only use one type of methods foe data collection. Questionnaires were used to called information from teachers of EYE, interview schedules collected information from the head teachers, and at the same time the researcher used the observation schedules to record any kind of information that he could observe. In this case therefore t triangulation helped in obtaining more reliable responses. The tools results from different tools enhanced each other thus making the results more reliable.

There could also be the limitation in the size of the study area. Bungoma County is a large county with nine sub counties. This made it very hard to acquire the required data on time. However, this was countered by ensuring the use of research assistants who assisted in data collection. The research assistants helped in dropping and collecting the questionnaires while the researcher concentrated on carrying out the interviews since they were fewer. This came with a cost. Nevertheless, this called for early preparation in ensuring there was sufficient funds, to facilitate the assistants who brought back the findings.

1.11 Assumptions of the Study

There are a few assumptions that were made: it was assumed that both early year's education teachers and head teachers were honest in their responses. It was also assumed that early year's education teachers and head teachers responded to the best of their abilities. Last but not least, there was an assumption that the results yielded from this research were a true picture of what is happening on the ground in EYE centres.

1.12 Theoretical Framework

This study was anchored on the TPACK framework developed by Mishra and Koehler (2006). TPACK framework was introduced to the field of educational research for understanding teacher knowledge required for effective technology integration (Mishra & Koehler, 2006). This framework arises from multiple interactions among content, pedagogical, and technology knowledge. It encompasses understanding the representations of concepts using technologies; pedagogical techniques that may apply technologies in constructive ways to teach content in differentiated ways according to students' learning needs; knowledge of what could make concepts difficult or easy to learn and how technology can help redress conceptual challenges; knowledge of students' prior content-related understanding and epistemological assumptions; and knowledge of how technologies can be used to build on existing understanding to develop new epistemologies or strengthen old ones (Mishra & Koehler, 2008). It is composed of seven domains: Technology Knowledge (TK), Content Knowledge (CK), Pedagogical Knowledge (PK), Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TCK), Technological Pedagogical Knowledge (TPK), and Technological Pedagogical Content Knowledge (TPCK).

TPACK domains and related subdomains address the complex nature of teaching effectively with appropriate technologies. While the different domains and subdomains

can be explored as separate skill concepts, domains and subdomains were conceptualized to work in synergistic reciprocity meaning that the knowledge is not entirely separate indicating the intersectionality of each area. Accordingly, the TPACK model consists of three main domains, each containing one subdomain. The purpose of the subdomains is to unpack the broader domain concept by understanding intersections among the three primary knowledge anchors for the overall framework.

The three subdomains of this theory are: Technological Knowledge (TK); Pedagogical Knowledge (PK); and Content Knowledge (CK). Technological Knowledge (TK) addresses how teachers demonstrate professional knowledge of technology. TK considers what is required for teachers to integrate technology tools and resources into their course content and instructional practice. The technology component of TPACK in Technology is most beneficial for learning when it brings a change in professional teaching practice and in designs for learning. For teachers, TK not only addresses knowledge about technology but also knowledge of the skills needed to use technology to effectively plan instruction, including with science teachers. TK involves understanding cross-platform applications and capabilities as well as how to configure those applications to realize instructional objectives and student learning outcomes.

This subdomain adequately addresses three of the four objectives of this study. These are; to assess teachers' competency in the use of technology in teaching mathematics activities in EYE; to determine teachers' attitude towards the use of technology in teaching mathematics activities in Early Years Education; and to establish how adequately technology is used in teaching mathematics activities in EYE; It is very important to note that out of the teachers' competency they can choose to use technology in handling the mathematics curriculum. Does one have the adequate knowledge about technology? Does one know how to relate the content with the chosen

technology? Is one trained on the same? All these will have a very big impact on the use of technology. In line with this, the attitude of the teacher is also very important. Positive attitude will call for effective use of technology in the implementation of the mathematics curriculum by the use of technology. However how knowledgeable one is, without positive attitude, it will be difficult to implement the same. Positive attitude is a sign of acceptance and high probability that the tools of technology will be used.

The teacher who is competent and has the right attitude will use the method and thus it will be easy for the research to ascertain how frequently technology is used by teachers. On the other hand, the frequency of use of technology will proof the competency of the teacher and their attitudes. Regular or and frequent use will explain the positivity of the teachers and their knowledge about technological tools used.

Pedagogical Knowledge (PK) addresses how teachers demonstrate professional knowledge of pedagogy. PK refers to the specific knowledge about teaching such as approaches or methods of how teachers teach a particular topic or how to scaffold a concept to the diverse interests and abilities of learners. For teachers and educators, an effective teaching method that engages students in higher-order activities using real-world examples facilitated through different learning styles is the cornerstone of teaching and learning in the current era. Accordingly, educators must be thoughtful in the instructional techniques to teach the subject matter as it may have a great impact on long-term learning and knowledge acquisition. This therefore addresses the forth objective about methods used by teachers in teaching mathematics activities in EYE using technology in Bungoma County. A teacher who understands his content well will choose the most appropriate method or approach to use in his or her lesson. In this case the teacher will have to pick on the methods that will resonate well with age of the learners and the teaching resources in this case the use tools of technology.

In the case of this study, where the researcher is trying to look at how technology can be integrated in the teaching of mathematics activities in EYE, the most appropriate approach is the use of simulation in teaching mathematics activities.

According to https://www.usa.edu/blog/simulation-in-education simulation-based education is the pedagogical approach of providing students with the opportunity to practice learned skills in real-life situations. Educational simulation is a teaching method that tests participants' knowledge and skill levels by placing them in scenarios where they must actively solve problems. This is with the case of the current CBC. Technology has been widely given preference where learners have the opportunity to interact with technology to make learning more practical. Learners have access to technological devices like phones, tablets and even desk top computers so ass to easily practice some concepts. They have also stated how simulation can be used which includes, engaging students to capture and maintain student attention, delivering "aha!" moments where students navigate through challenging and realistic scenarios, helping teachers in you assessing and grading their students and last but not least Providing a perfect backdrop for an interactive conclusion of the activities being taught.

Https://www.skillsyouneed.com/rhubarb/technology has given examples of approaches that are technology based which can be used by EYE learners in this 21st century. These approaches include, flipped classroom. Digital literacy, gamification, inquiry-based learning, active learning, blended learning, and game-based learning. Project-based learning, collaborative learning, student-generated content, and collaboration platforms are a few examples.

Content Knowledge (CK) is situated within the following definitional parameters of a teacher's knowledge about a particular subject matter and how it is taught and learned. As Shulman (2013) noted, CK would include knowledge of concepts, theories, ideas,

organizational frameworks, knowledge of evidence and proof, as well as established practices and approaches toward developing such knowledge." For educators, effective content instruction that engages students in higher-order activities using authentic, real-world examples facilitated through technology is the cornerstone of teaching and learning in the 21st century. Thus, educators must not only be thoughtful in the instructional techniques they use to present content but also strategic in the technology selected to teach the subject matter as it may result in positive or negative results in long-term learning and knowledge retention.

To wind up, this theoretical framework has been divided in three major subdomains which relate very well with the study objectives. The subdomains entail, the Technological Knowledge (TK), Pedagogical Knowledge (PK), and Content Knowledge (CK). The domains combined together will give a strong web of the use of technology and thus hopefully this will improve performance at both individual and the subject performance. With competency Based curriculum, positive attitude, use of appropriate methods and regular use of technology, it is hoped that there will be positive impact to classroom instruction in Early Years Education. This will be a hands on classroom. The diagrammatic elaboration has been shown in Figure 1.4 below.

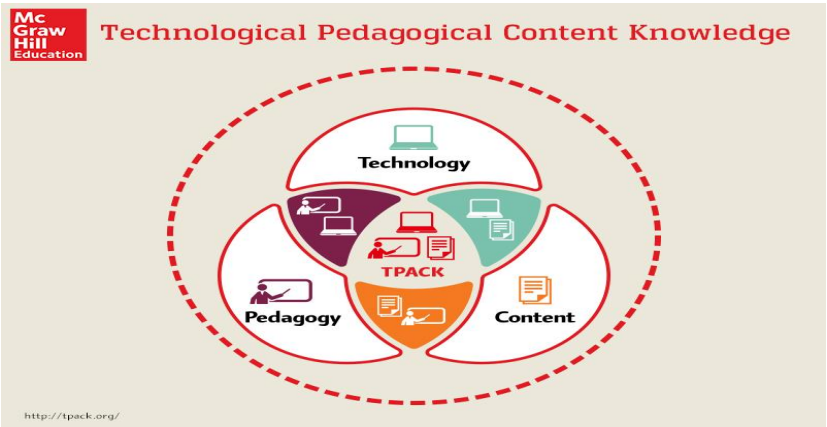

Figure 1.4 Theoretical Framework

Source: https://www.mheducation.ca/blog/what-is-tpack-theory-and-how-can-it-be-used-in-the-classroom/

1.13 Conceptual Framework

The research topic has independent and dependent variables. The independent variable is “The integration of technology in Mathematics curriculum,” while the dependent variable is “The implication on classroom instruction.” Each of these variables is characterized by features which are inherent in the study’s objectives. Broadly, the manipulation of any of the features in the independent variable by the teacher of Mathematics in Early Years Education influences how teaching is executed (the dependent variable).

Starting with the independent variable, the first feature is the teacher’s overall competency which includes technical skills to appropriately use technology. The level of teacher’s competency influences how the teacher plans and uses technology in the actual teaching in class. The teacher who is knowledgeable on how technology works will be able to comfortably plan and use it in class.

The second independent variable in this study is the teachers’ attitude towards the use of technology for instruction purposes. Attitude has a bearing on whether the teacher shall use technology in the actual teaching or not and how this technology shall be used. A teacher who has positive attitude will do all that he or she can to use a technological tool. The frequency of use of technology solely depends on the teachers’ attitude.

The third feature of the independent variable is adequacy of technology in teaching mathematics activities in EYE. Whether the available technology is adequate or not, shall influence how the teacher conducts instruction in the classroom. One can only use what is available. It should be realized that in the error of free primary Education, the school enrolment is high and this can easily pose a challenge where the technological equipment is not adequate. It is only in schools where we have adequate technological

equipment that the teachers will choose to use them. In cases where we have insufficient tools, teachers will choose to use the traditional methods in their instruction.

The fourth and last feature of the independent variable is the level of teachers' knowledge of the teaching methodologies that appropriately lent themselves to the teaching with technology. This for instance can be through approaches such as use of interactive whiteboards, gamification techniques, and online collaborative tools. All these methodologies can be put in practice when the teacher understands content and can easily choose the most appropriate method for each approach. The diagram below provides a visual expression of the relationship between the research variables for this study.

The operationalization of this conceptual framework is greatly influenced by the intervening variables which are aptly discussed in the theoretical framework guiding this study. They comprise of the three domains of the TPACK theory: the Technological Knowledge (TK); the Pedagogical Knowledge (PK), and the Content Knowledge (CK) in Figure 1.1 Theoretical Framework.

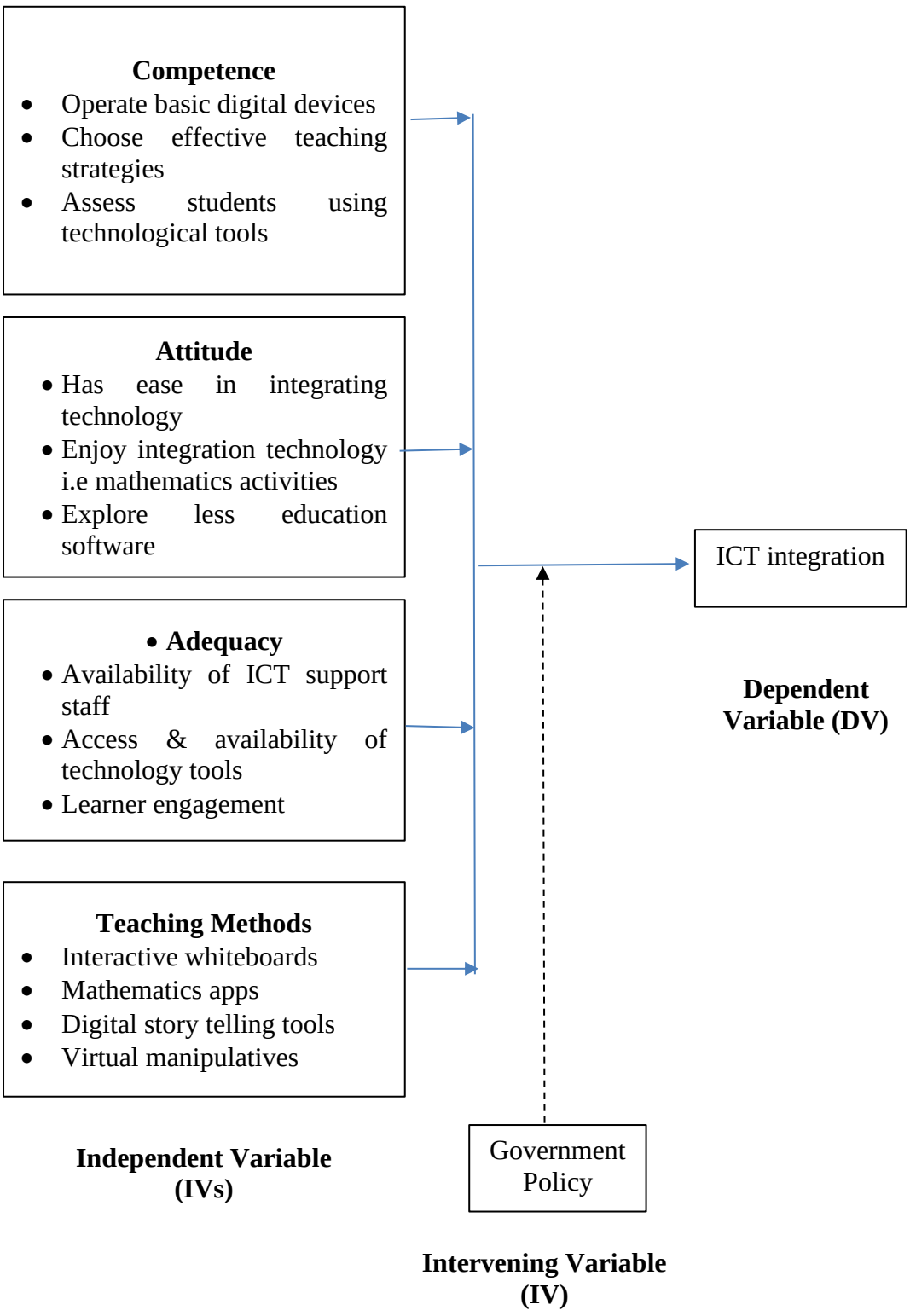

Figure 1.5 Conceptual Framework

Source: Researcher, 202

1.14 Operational Definition of Terms

Attitude: These are teacher's beliefs, feelings, and perceptions towards the use of technology in teaching mathematics activities in EYE.

Competence: This denotes the teacher's ability to effectively use technological tools in teaching mathematics activities in EYE; this includes knowledge, skills and confidence in using technology. It is measured by their level of digital literacy, proficiency in operating educational technologies and their capacity to design and implement technology enhanced activities.

Early Years Education: Early learning refers to programs that provide education for children between the age of 3 years and 8 years old outside their own home and before primary level

Extent of Use: It is the frequency, duration, magnitude and regularity or how often and variety of technological tools applied in teaching mathematics activities in EYE. It is measured by frequency and duration of technology use during lessons and variety of technological tools used in teaching mathematics activities in EYE.

Government Policy: these are national or institutional directives, guidelines, frameworks and regulations that govern the integration of technology in Early Years Education. In this case, they are official guidelines, regulations and directives governing the use of technology in early Childhood Education in Kenya.

Integration: This is the degree to which teachers incorporate digital tools into teaching mathematics activities in EYE.

Learning: Is the process of gaining knowledge and expertise in utilizing information communication and technology.

Level of learning outcomes: These are the different learning outcomes achieved at Basic Education Framework. In the case of this study , it is what is acquired by learners of EYE during their interaction with technology in mathematics activity lessons.

Levels of ICT integration: In the case of this study, technology is being introduced into teaching and learning mathematics activities in EYE.

Teaching Methods: These are specific instructional approaches employed by teachers in teaching mathematics activities in Eye.

Teaching: It is a systematic and purposeful instructional practices employed by teachers of EYE during mathematics activities' lesson. It entails Planned and structured actions carried out teachers of EYE during the lesson.

Technology. In this case it is all about the tools that are integrated in teaching and learning to cause an impact in learning of mathematics activities in EYE.

1.14 Chapter Summary

The chapter has discussed and presented the preliminaries of the study as a preparation for the remaining chapters of the study. The rest of the study has chapters two, three, four and five. Chapter two deals with literature review, chapter three highlights the procedures followed in in conducting the study, chapter four provides analysis, presentations, interpretation and discussion of findings. Last but not least, the fifth chapter provides conclusions, recommendations and suggestion for further studies.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The literature review section examines the works of prior comparable studies empirically to highlight the knowledge gaps apparent in teachers' competency in teaching mathematics activities in EYE using technology; teachers attitude towards using technology in teaching mathematics activities in EYE, hoe adequately technology is used in teaching mathematics activities in EYE and the teaching methods used by teachers in teaching mathematics activities in EYE using technology.

2.2 Use of Technology in Teaching Mathematics Activities

The term "information communication technology" (ICT) refers to any electronic devices and the communication infrastructure that enables them to communicate with one another either automatically or as tools in the hands of people. The phrase took the place of the formerly popular acronym IT, which continues to be used to describe feature-rich equipment (particularly computers and computer devices) and the internet. This change resulted from the concepts of information and communication being expanded in response to the diversity in their definitions based on the contexts in which they are used and the goals they are intended to achieve. Due to its contextual character, which adds value, the world has evolved to perceive information as a tool similar to how it views ICTs, with the result being knowledge (Siraj Blatchford & Siraj Blatchford, 2003). Learning is the process by which people and groups bring together the knowledge and resources at their disposal to create meaningful and practical insights that simplify their professional and personal lives while addressing issues and obstacles they encounter.

As a result, ICTs have the potential to revolutionize education since their primary role is to assist knowledge management by offering a structured environment that gives students the tools to encourage learning, especially as the world becomes more and more digital. Furthermore, because everything is so interconnected, technology's capabilities allow individuals to observe the effects of their activities both locally and globally, which helps them develop interventions and solutions that are more practical and long-lasting. It therefore offers to increase a country's or institutions monitoring power over additional elements in its working environment, making it more strategic.

Learning outcomes are considerably improved by the expanded knowledge and management capabilities that technology offers to a system's numerous components (Kang & Im, 2013). It achieves this by empowering students with the skills to actively direct their own learning and to create evaluation procedures that assist them fill in knowledge gaps that prevent them from attaining better results (Dunn et al., 2013). Additionally, it gives students the resources to interact with their peers, connect with subject matter experts, and access a variety of information sources to deepen their comprehension of the ideas they wish to study. Additionally, because technology makes it easier to alter and add to the body of knowledge, it also enables students to contribute to making content simpler to absorb and comprehend by using the many toolkits available to develop more efficient delivery modalities like videos (Voogt and Roblin, 2010).

Thailand's government undertook an ambitious effort to enhance the quality of talent produced by the country's educational system, which included devising interventions to protect the nation from the rising risk that globalization continues to bring. As a result, the nation has been able to raise learning outcomes by establishing rules that have improved the learning environments in its schools and encouraged institutions to take

advantage of the nation's expanding technological advancements to enhance their service delivery, particularly to young learners. Additionally, by tying these tactics to their national technology strategic plan, the nation has put itself in a position to develop high-performing personnel perpetually to manage its digitalization agenda and contribute to the long-term creation of new economic revenue streams.

By establishing a closed loop system between educational institutions, businesses, and the labor market, aligning education goals with the nation's long-term goals significantly enhances learning results. Increased interdependence between these two fundamental components of economic development and growth enhances the nation's ability to maintain its competitiveness on the international stage. It accomplishes this by enhancing their ability to follow the development of issues and difficulties affecting many regions, providing them the foresight to develop the abilities and talents required to address them. Additionally, it actively produces substantial amounts of data that aid in the construction of frameworks and policies that are adaptable enough to change along with the situations and contexts of the global environment (Pelgrum, 2001). Because of its ability to maintain a strategic approach to the growth of its talent pool and educational system, Thailand has been able to significantly lower unemployment rates and help its citizens find jobs.

The utilization of computers as well as ICTs in the classroom has changed significantly over the years as many institutions and nations have attempted to establish adoption methods that provide them greater returns. Initiated as stand-alone courses with dedicated laboratories to educate students how to use the many aspects of computing devices to improve their capacity to manage knowledge, their use has subsequently developed into the use of ICTs as supplemental tools in the learning process. With nations and institutions in the same areas demonstrating a convergence in their growth

patterns, there is also a clear tendency in the creation of policies and procedures directing the development and management of curriculum. By utilizing ICTs' processing and communication capabilities to improve the performance of all stakeholders, institutions may make the most of the integration of ICTs by following sound practices (Pelgrum & Voogt, 2005). Additionally, they make it easier to analyze the massive amounts of performance data sets that the various system components and processes produce, raising the system's levels of responsibility.

Existing research indicates that integrating ICT into the classroom boosts students' morale and results in improved performance (Boyd, 2013, Machell, McHugh, Passey, Rogers). Teachers' workloads are greatly reduced as a result of their students' improved performance and engagement in the learning process, which also significantly boosts their motivation by allowing them more time to concentrate on offering their students more value. These benefits further improve the learning environment and foster interactions that strengthen the bond between instructors and students, helping both parties comprehend the course topics more fully. ICTs have made it easier for institutions and their administration to access all the information produced by their procedures, which has increased accountability. They may devote more time and resources to refining processes and systems so that they provide greater value to stakeholders, particularly their students and instructors, thanks to the time savings it makes feasible. Additionally, leveraging technology enables schools to significantly reduce the cost of printing and mailing student report cards while simultaneously increasing the likelihood that parents will get them.

The most crucial feature of ICT integration is quickly evolving to know what combinations, particularly of soft and software, deliver the most benefits to digital learning methods due to technology's high degree of dynamicity and the daily creation

of new devices and platforms (Clements, 2002). The choice of software is quickly becoming into the sole factor that policymakers may use to boost the effectiveness of their plans at the moment, and most likely in the future as technology brings about the convergence of the processing capabilities of the majority of devices. Additionally, research has demonstrated that the usability of software has a significant impact on the attitudes and views of its users, thus elevating their significance in the conception of technology integration in education. It is particularly crucial to take this into account when choosing and training instructors because they play a crucial role in fostering positive attitudes in students, which in turn helps them develop long-lasting, efficient learning habits. Additionally, when instructors and students have similar attitudes, they can both contribute significantly to raising the effectiveness and results of the entire system.

Teachers' jobs should be to guide students in using these resources to increase their capacity for grasping new ideas and using their acquired knowledge to solve issues in context. Children already engage with and come into contact with ICTs on a daily basis, and they frequently have access to a greater variety of services and applications. Due to the enormous volume of applications and information that reach the market every day and can be overwhelming if one does not know how to curate them properly, it is especially important (NAEYC, 2009). Protecting the integrity of their own computer systems and those of others to which they have access is another benefit of teaching children how to be safe. This is because at least twice as much corruptible and hazardous material is being produced. These ideas are echoed in the Albert Shanker Institute's (2009) advice that technology exposure begin as early as kindergarten. This is due to the fact that it enhances learning outcomes as well as offers young pupils a feeling of self-worth and self-efficacy that boosts their ability to manage more

challenging subjects in the future and equips them with the necessary skills to do so (Epstein, 2007).

Ertmer (2005) asserts that organizations seeking to maximize the gains from technology integration into their educational initiatives should adopt a comprehensive strategy similar to Thailand's. He continues by noting that they can only use techniques that result in integration at the core of their operations if they want to see a significant shift in how they provide content and how their students convert this information into meaningful knowledge. This implies that they could also need to hire professionals to assist them in creating suitable frameworks to instruct their instructors on how to integrate their conventional lesson plans and resources with the new digital platform. Due to the potential impact on their staff's workload, it may also mean that in the beginning, they will need to utilize the same contractors or hire more people to convert their existing materials. This will assure the continuity of their learning processes.

Similar to any other technical concept, learners benefit from exposure early in their learning development by developing higher abilities. This is partly because it shortens their learning curves and mostly because there is a stigma attached to not understanding certain things as an adult, which could hinder someone's ability to learn them. Consequently, using ICTs in education, especially in the formative years, has the potential of improving institutional outcomes in both the enhancement of teachers' working conditions and the enhancement of students' performance (Van Scoter & Boss, 2002). Furthermore, because it gets ingrained in the character of the learners, studying ethics sooner has demonstrated long-term advantages. To put it another way, if presented to students early in their lives, they should develop into responsible users of the technologies at their disposal as well as unintentional police agents who seek to make the online environment safer for all users.

Technology now permeates every aspect of our lives. The amount of media, technology, and screen time that kids are exposed to at home and at school has skyrocketed (Sharkins et al., 2016). Children are using smartphones to interact with them in greater numbers. Fewer than eight year old pupils have access to technology in around 98% of cases (McCarthy et al., 2018). By giving them real-world experiences in the classroom, technology has helped to educate our kids for the 21st century (Bavelier et al., 2010). All aspects of development examined in early childhood classrooms have been impacted by technology. The influence of technology on young children's development was the main topic of this research study. A child's development in the areas of (a) social and emotional, (b) physical, (c) cognitive, (d) language, (e) mathematics, and (f) literacy abilities may be impacted by technology. We'll go through the benefits and drawbacks of technology in each of these early childhood developmental domains. Digital natives have been used to characterize kids (Sharkins et al., 2016). Children nowadays have been described as belonging to the internet and digital technology generation (Sharkins et al., 2016). Children have been exposed to electronics at a young age. There have been several gadgets, including PCs and tablets. While utilizing technology, kids have explored and learned new ideas.

Technology has been described as a resource that students may utilize to study and advance (Sharapan, 2012). The National Association for the Education of Young Children (NAEYC) addressed the use of technology in the early years in a developmentally appropriate manner. Technology has enhanced education and catered to young children's needs at home and in the classroom.

According to Quesenberry, social emotional development in an early childhood classroom is defined by taking responsibility for oneself and others, playing peacefully, sharing resources, and taking turns (2016). In terms of how they learn, speak, and

interact with others, technology has created new opportunities for young children's social emotional development (Savina et al., 2017). Three recent studies have begun to shed light on how young children's social and emotional development has been influenced by technology (Bracken, 2015; Ralph, 2018; Quesenberry, 2016).

When kids play together and share technology in early childhood settings, their social connections grow (Quesenberry et al., 2016). Clements and Sarama (2002) found that students interacted with peers online nine times more frequently than they did crossword puzzles. Children and computers do not separate, according to study. Children's attention and good feelings increased when they worked together on computers with their friends (Clements and Sarama, 2002). The American Academy of Pediatrics recommended against allowing children to use gadgets by themselves and endorsed this opinion.

According to Bracken (2015), children that participated in lessons with iPad help showed cooperation, inclusivity, critical thinking, and problem-solving skills. Additionally, Bracken saw a rise in student-directed learning. The kids' social connections improved as a result of the iPad, which promoted peer collaboration. For the pupils, this was an engaging and fun event. His research found that if technology was properly integrated into an early childhood classroom, it could be used as a social tool. There were worries that technology, particularly entertainment media, led to children becoming violent, preoccupied, and addicted (Bavelier et al., 2010).

According to the National Association for the Education of Young Children (NAEYC), technology and media may be helpful when utilized appropriately. According to the NAEYC, technology should be educational and developmentally appropriate. Technology should be implemented in schools to enhance social interactions.

A research on activities with and without the usage of an iPad was undertaken by Ralph (2018). Students aged three to four and an early childhood instructor was involved in this study. The study concentrated on ideas of social learning and social exchange. The research outlined benefits of using digital learning in early childhood classrooms. Ralph also considered the potential drawbacks of bullying, antisocial conduct, and overstimulation from technology. Her findings didn't seem to support these harmful impacts, according to the data. Instead, great social conduct was noticed and recorded. The kids were enthusiastic and involved in their collaborative learning. This most recent research revealed that shunning social media and technology was becoming just as contentious as doing so in an early childhood classroom (Ralph, 2018).

Technology and hands-on activities in the classroom must be balanced for good social and emotional development. Teachers may plan and apply technology in their classrooms to make sure it is developmentally appropriate for the welfare of their students. In order to satisfy the social and emotional needs of young students in a classroom context, technology selection, integration, and assessment were essential (Quesenberry et al., 2016).

Toddlers who used touchscreens showed signs of motor development by (a) hitting the screen 16%, (b) tapping 71%, (c) dragging 41%, (d) swiping 20%, and (e) pinching 10% (Bedford et al., 2016). The most current research by Bedford has started to provide light on how technology could enhance physical development in young children. However, new research from the American Pediatrics (2016) and Mendoza et. al., (2017) raised concerns about potential harm to young children's physical development and exposure to electronics.

Bedford et al, (2016) found that toddlers required to actively interact with applications using their fingers as opposed to passively looking and monitoring the gadget. By leveraging technology through scrolling, touchscreens gave young toddlers a sensory experience. In his research of the physical development of toddlers ranging in age from 19 to 36 months, Bedford discovered an improvement in fine motor abilities and the accomplishment of the pincer grasp as a fine motor milestone. Touch displays and gross motor development did not appear to be significantly related, according to Bedford. To establish and validate these findings for physical development, more study was required (Bedford et al., 2016).

Concerns were raised about technology, kids' overall health, and their physical development. Researchers looked at 1,809 children and found a connection between screen use and obesity (Mendoza et al., 2007). Preschoolers should participate in more physical and gross motor activities and less screen time, according to recommendations (Kracht et al., 2020). The recommendations about screen time should be followed by parents and teachers (The American Academy of Pediatrics, 2016). The American Academy of Pediatrics claims: Children under the age of two require interactive play and social contact with trustworthy caregivers in order to develop their cognitive, linguistic, motor, and social emotional skills. Limit screen time for kids ages 2 to 5 to one hour per day of high-quality television, co-watch with your kids to ensure they comprehend what they're seeing, and encourage them to utilize what they've learned to better the world. Teachers may design interactive technology-based activities that would encourage students to move around the classroom. The American Academy of Pediatrics (2016) urged teachers to creatively utilize modern technology to foster a healthy learning environment.

Children's use of technology may affect how effectively they recall information, focus, and seek out information, and think, claims Danovitch (2019). Recent research by the team illuminated the potential effects of technology on young children's cognitive development. From birth to age 8, children's social and cognitive abilities quickly developed as a result of their exploration and learning of their environment. Danovitch (2019) asserts that the majority of inquiries and studies into cognitive development centered on whether or not technology aided or hindered memory. While some research claimed that technology reduced memory (because machines could retain everything), other researchers found that software with built-in basic memory capabilities helped students focus on more challenging, critical thinking tasks (Ismaili et al., 2017). Danovitch found that using technology to access information could be beneficial if students were able to quickly and easily find the answers to their questions, but it could also be detrimental if they were unable to find the answers they were looking for, as this could cause frustration or discouragement (Danovitch, 2019).

According to Ismaili et. al., (2017) definition, assistive technology refers to tools that help kids with physical or cognitive disabilities navigate challenges at home and at school. For a variety of illnesses and limitations, assistive technology may be used (Ismaili, 2017). Attention Deficit Hyperactivity Disorder is categorized as a neurodevelopmental condition (Powell et al., 2017). In order to improve cognitive development in children with attention deficit hyperactivity disorder, technology has been used (ADHD). Computer games have been used to improve conduct and organizational skills, as well as to hone math skills and quicken reading. Powell (2017) reviewed 7,545 researches, including 14 that focused explicitly on how technology affects kids with attention deficit hyperactivity disorder (ADHD). Although more research is required to support this claim, technology may assist hyperactive and

impulsive children with ADHD in learning to manage their behavior. This study also suggested that research be conducted on subjects other than video games and that participation in technology should constantly be encouraged (Powell et al., 2017).

Vatalaro et. al., (2018) defines expressive language as words that be spoken aloud after being retrieved intellectually. The goal of receptive language is to understand words as they are read or heard. Two recent studies have begun to shed light on the potential effects of technology on young children's language development (Crowe et al., 2017; McPacke, et. al., 2013). Other forms of communication that may be done via technology include text, pictures, videos, emoticons, and sound. Young children may use digital tools to communicate creatively even if they couldn't yet read or write (McPacke et al., 2013). By embracing digital tools, teachers might provide all students a platform to express themselves.

Preschoolers with speech impairments were intended to get help from early childhood teachers so they could thrive in the classroom. Speech Sound Disorders (SSD) impair children's ability to engage in meaningful social interactions (Crowe et al., 2017). Even though they were still learning how to utilize it, youngsters understood the purpose of technology. For instance, a young child may have played on a malfunctioning computer or pretended to chat on the phone. The usage of technology by adults or older children in the area where children live is something that kids see all the time (McPacke et al., 2013).

In the school, it can be difficult for kids who have communication issues to share and interact with classmates as well as adults. By utilizing assistive technology, teachers may motivate students with disabilities to engage in class and interact with their peers, especially those who struggle with speech and language (Ismaili et.al., 2017). Children

might also be at risk for communication problems in the future that are related to academic skills like reading and writing. Along with their ideas and feelings, students may utilize technology to express their wants and wishes. Now that there are digital tablets available, students with speech impairments may play with their pals. Children's communication, teamwork, and creative abilities have improved thanks to play and technology (Fantozzi et al., 2018).

Fokides (2018) discovered that a lot of pupils struggle with arithmetic and have a bad attitude toward learning the fundamental math concepts and drills. By using game-based learning (GBL), digital math games might be used to teach students and change their unfavorable attitudes about the subject. (2018) Fokides According to Lambert et. al., (2014) research, children in early childhood schools were required to employ numerical concepts and operations, investigate and explain spatial connections and forms, compare and contrast, and show an understanding of patterns. Recent research by Fokides (2018) and McCarthy, Tiu & Li, (2018) have started to explain how technology might disrupt young children's mathematical development.

According to Fokides' (2018) study, pupils who were taught arithmetic using digital games fared somewhat better on tests than those who were taught the subject in the traditional manner. The pupils said they enjoyed learning arithmetic and were driven to do so (Fokides, 2018). McCarthy, Tiu & Li (2018) performed a second study on three and five-year-old children utilizing the well-known character Curious George, digital math games, and hands-on activities. 49 kids, or a whopping 96% of the participants, played at least 15 of the 16 Curious George games. The interventions, according to the teachers, were a useful addition to the classroom, highly motivated students to learn, and gave the kids practice with foundational math skills (McCarthy et al., 2018). These new research have started to provide light on how early children technology use may

influence mathematics development in a favorable way. Children exercised arithmetic concepts in the majority of research investigations on the relationship between digital games and mathematical growth, but there were only modest advances in accomplishment that were recorded. Nevertheless, given that it fosters children's enjoyment, improved involvement, and teamwork, technology may still be used in the classroom. The digital games should be carefully chosen such that they were engaging and offered possibilities for learning for pupils (Miller, 2018).

Technology might be used by teachers to deliberately arrange their math classes in order to interest and excite their pupils. A fresh and creative approach to leveraging digital tools and technologies for academic education was game-based learning (GBL) (Fokides, 2018). Technology might motivate children to acquire the repetitive arithmetic skills they must practice in order to master them in an enjoyable way inside the classroom.

Emergent literacy abilities were described by Neumann and Neumann (2014 pg.99) as understanding of letter names and sounds, early writing, print ideas, and phonological awareness. These abilities could serve as building blocks for further reading and writing abilities. The latest research by Neumann and Neumann has started to shed light on the potential effects of technology on young children's literacy development. Touch screen tablets helped the development of early reading skills since they resembled books and included a writing surface. Children used their fingers to flip pages, point at text, and follow objects on tablets. Assessments of print ideas resulted in higher results, according to teachers (Neumann and Neumann, 2013).

Only a few applications, according to recent research, supported young children's emerging literacy abilities. Only 56 out of 315 Apple applications were classified as

"Education," according to the analysis done by Orrin and Olcese in 2011. (Neumann and Neumann, 2013). Three categories of applications have been highlighted as being helpful to young children: game apps, creation apps, and e-book (digital book) apps. Typically, gaming applications maintained score. App development allowed for inventiveness. The majority of e books were read aloud fiction (Neumann and Neumann, 2013). According to some study, the visual and interactive distractions in e-books reduce comprehension and interaction. It has been demonstrated that Sesame Workshop and Public Broadcasting Service (PBS) applications are helpful in teaching young children literacy skills (American Academy of Pediatrics, 2016). Writing and reading were two essential elements for the development of literacy. Children were allowed to debate and take part in storytelling by using technology. Digital storytelling could be utilized anywhere and was portable. Sharing a student's work with other pupils was made simple by this method. Students might utilize a variety of digital resources, such as images, sound, music, cameras, and scanners, to construct tales (O'Bryne et al., 2018).

According to Dunn and Sweeny's (2018) study, pupils found writing using the standard tool - a pencil - boring and exhausting. When pupils were given access to digital tools and text, they were motivated and interested (Dunn and Sweeny, 2018). Utilizing technology also helped with oral communication abilities and the capacity to utilize a gadget to recount a tale in chronological sequence. Students' comprehension improved as a result of the films, animations, and sounds they saw and heard when utilizing technology, for instance when learning sight words (Oakley et al., 2018). Teachers were nevertheless urged to employ a balanced strategy for reading and writing in order to advance literacy (Dunn and Sweeny, 2018). Children might utilize and experiment with a variety of instruments in an early childhood school, including paper, pencils, cameras,

photos, crayons, markers, and styluses. When designing literacy courses for young children, the choice of resources, manipulatives, and apps was crucial.

2.3 Teachers' competency in teaching mathematics activities in EYE using technology

Findings in teacher training, and professional development for early childhood education (Ananiadou and Rizza, 2010; Tondeur et al., 2017; Casillas et al., 2020) show future teachers' perception of medium digital competence. While the COVID-19 crisis increased the emphasis on training and professional development in ICT and digital competences for early childhood education. In some cases, however, training programs were limited to using some online platforms, and there were no pedagogical practices and digital competences built for effectively engaging in online or distance education with young children (Atiles et al., 2021). According to a recent study (Galindo-Domínguez and Bezanilla, 2021), pre-service early childhood educators scored much lower on content creation than on other aspects of digital competency. Supporting the creation of digital material is essential, as discussed by Galindo-Domínguez and Bezanilla (2021). Both teachers and children already from an earlier age are expected to be not only end-users of technology but to become content creators (Drotner, 2020). More digital creativity in the learning environment also leads to more effective implementation of active and innovative methodologies (López Belmente et al., 2019).

Teachers' digital competences are often developed through the means of teacher professional development (TPD) programs that utilize co-creation related social processes (Prieto-Alvarez et al., 2018) while providing teachers with knowledge and skills about certain STEAM approaches or technologies (Herranen et al., 2021). In such training programs, experts of various domains (e.g., technology, pedagogy, and learning content) combine their knowledge in order to provide participants with in-

depth knowledge about using the selected technologies in the context of teachers' everyday teaching routines (Leoste, 2021). The co-creation approach relies on the ideas about user innovation, where end-users are involved in co-creation of innovation-related artifacts (in the context of education: teaching methods and relevant materials, related to various educational digital technologies), leading to higher user motivation and better innovation adoption rates (Von Hippel, 2017; Bradonjic et al., 2019).

According to earlier studies, iteratively structured longitudinal training programs that comprise contact day cycles followed by participant co-creation and implementation activities can better enhance participant learning (Botha and Herselman, 2018; Leoste et al., 2020). In a similar vein, Henriques et al. (2021) support lengthier training sessions since they would enable participants to more effectively connect the material they have learnt to their practical applications. Additional research also supports this continuous training strategy that is practice-oriented and centred on daily instruction (Papadakis et al., 2021b).

However, the question of duration is not an easy one as different authors define it differently. In their literature review on formal teacher training programs, Burgess and McGregor (2018) describe short programs that last a few hours to a few weeks. However, they also include longitudinal programs that span several years and provide tens of contact hours along with a few online modules. In general, it seems that a course that lasts less than a semester is considered a short-term program, while a program with longer duration is considered a long-term program. While the short-term training courses might not see the same maturation of participant knowledge compared to long-term courses, they still have some important benefits. For example, short-term courses could lead to savings in financial resources, and are also less demanding on teachers' already intensive schedules (Leoste et al., 2019).

2.4 Teacher's Attitude towards Using Technology in Teaching Mathematics Activities in Early Years Education

Teachers' attitudes and beliefs regarding the instructional value of technology play an important role in determining how fully they integrate technology into the classroom. Chen (2008) explored the relation between teachers' pedagogical beliefs and technology integration. Findings indicated inconsistency between the teachers' expressed beliefs and their practices. Despite studies documenting the effectiveness of technology to support student learning, Staples (2007) said many teachers had not been prepared to teach with technology in their teacher preparation programs. Poor preparation is a barrier to full integration (Ertmer & Ottenbreit-Leftwich, 2010). One of the major changes in the world of education and work is near-constant technological advancement, with a definite move towards the use of technologically sophisticated ways of getting things done. New technologies are transforming education and businesses.

Since preschool teachers are one of the key individuals who influence children's learning, it is crucial to comprehend their views towards ICT (McCarrick & Li, 2007). Nevertheless, there aren't many studies in Turkey that examine the attitudes of preschool teachers towards ICT. According to the literature analysis of recent studies, preschool teachers have a positive attitude on the usage of technology (Konca, 2014). According to Lindahl and Folkesson (2012), preschool teachers state that although technology helps children succeed and learn, it can sometimes be challenging to utilise. Furthermore, it was found that the organisation where instructors work is having trouble providing them with hardware and technical assistance (Kabadayı, 2006). An analysis of preschool teachers' usage of ICT in the classroom revealed that they primarily used it for lesson planning and music-related activities. Teachers' opinions on ICT were also

found to affect students' attitudes and increase their motivation (Yurt & Cevher Kalburan, 2011).

When the attitudes of preschool teacher candidates were examined, it was discovered that they also had positive views about using ICT (Oğuz, Ellez, Akamca, Kesercioğlu & Girgin, 2011). However, research shows that the courses pre-school teacher candidates studied about ICT during their university education do not align with the expected amount of ICT use in preschool education settings (Kalogiannakis, 2010). Preschool teachers require more than simply basic computer skills to integrate ICT into their classes, even if ICT literacy is founded on these skills (Wetzel, Wilhelm & Williams, 2004). When it comes to the use of technology by preschool teachers, it is crucial to identify and enhance the training that both instructors and teacher candidates receive in this area (Yıldırım, 2000; Chen & Chang, 2006). The function of ICT in preschool education was determined by the preschool teacher candidates' education in this area (Kalogiannakis, 2010).

2.5 Teaching Methods used by Teachers in Teaching Mathematics Activities in EYE using Technology

Young children nowadays are members of the "digital native" generation (Fleer, 2011; Prensky, 2001). In this study, young children are defined as those aged 0 to 8 years. They utilize technology on a daily basis and live in a technologically advanced society (Plowman, Stevenson, Stephen, & McPake, 2012). The growing influence of technology on children is acknowledged in many nations. They place a focus on the creation of technology-integrated curricula that are age-appropriate for young children and that serve to connect young children's digital experiences at home and at school (Plowman, Stevenson, McPake, Stephen, & Adey, 2011). Technologies have impacted children's life and learning processes due to their fast growth, notably in the last 10

years. Researchers have advocated a reevaluation of how technology affects early children's development and, as a result, the creation of learning theories and curricula that are appropriate for today's youngsters (Fleer, 2011; Yelland, 2011). Even though many teachers and academics have argued for the importance of young children learning with technology and devoted themselves to researching and implementing technology related practices, the effect of young children's usage of technologies on their development is still up for debate. Some studies suggest that the usage of technologies may impede these children's social, psychological, physical, and cognitive development, while other experts believe that technology may aid young children in developing in the aforementioned areas (Cordes & Miller, 2000).

These discussions revolve around a single issue that early childhood teachers are worried about: are the technology-related behaviors developmentally suitable for young children (Radich, 2013)? Knowledgeable people play crucial roles in scaffolding young children's learning within the zone of proximal development in terms of developmentally appropriate actions. Therefore, researchers are interested in how technology-assisted learning and adult-facilitated learning affect children's learning. For instance, De Jong and Bus (2004) studied the effects of reading e-books independently vs listening to people read storybooks on children's learning outcomes. The method of having kids manipulate physical items to teach them abstract concepts is another illustration of a technique that is developmental appropriate (Dunn, 2001; Hsin, 2014). Thus, researchers have questioned the consequences of modifying real-world and digital resources on kids' acquisition of science and mathematical ideas (Zacharia, Loizou, & Papaevripidou, 2012). Additionally, encouraging social skill development is regarded as one of the crucial developmentally appropriate behaviors for young children. Some academics contend that the use of various technologies by

young children may hinder their development of social skills since these abilities are acquired through in-person interaction, which technology use prevents (Armstrong & Casement, 2000). Contrarily, other experts claim that technology really fosters children's social development in a number of ways (Infante et al., 2010). Researchers claim that the strategies they promote are developmentally appropriate on both sides of the debate. The complex connections between children's technology use and their learning, however, may be missed by researchers and teachers as a result of such binary discussions. The goal of the study is to develop a typology that will help people understand how key factors that affect how well children learn to use technology interact with one another.

2.6 Related Studies

Technology use in young children must be taken into account (Queensberry et al., 2016). The effectiveness of a plan to integrate technology into an early childhood classroom was demonstrated through research. Early childhood classes must strike a balance between technology and other subjects. The social, emotional, physical, linguistic, cognitive, literacy and numeracy needs of every student cannot be fully satisfied by technology. For teachers, technology may be a crucial component of the jigsaw that completes the learning process from teaching to application.

In early childhood classrooms, teachers must carefully choose which technological tools to employ and how to utilize them (Quesenberry et al. 2016). In order to fulfill the requirements of each student, teachers carefully examine if utilizing technology is relevant, engaging, and developmentally appropriate. The finest applications and gadgets for a certain learning environment can be decided by teachers. There are several instruments available, including laptops, iPads, and interactive whiteboards. When instructors are preparing their lessons and activities, they have access to a wide range

of applications. Children may grow socially, emotionally, physically, linguistically, cognitively, literately, and mathematically with the help of technology, which can also accommodate the requirements of all learners to help them succeed academically and socially in the school setting.

Early childhood schools need to integrate how technology was utilized (Quesenberry et al., 2016). In all the major areas of early childhood teaching and development social emotional, physical, linguistic, cognitive, literacy, and mathematics technology may be included into the daily classroom calendar. Teachers may keep an eye on the results and offer learning opportunities that are suitable for their students' growth stages.

The use of technology in early childhood schools has to be assessed (Quesenberry et al., 2016). Developmental milestones can be tracked before and after teachers employ a piece of technology or software with their children to gauge the effectiveness of the resources. As with other facets of the curriculum, instructors will need to consider and assess this information.

Early childhood students' social emotional, physical, cognitive, linguistic, mathematical, and literacy ability development is impacted by the use of technology in the classroom. Researchers looked into the benefits and drawbacks of technology. When properly chosen, integrated, planned for, and assessed, technology instruments can have a positive impact on children's learning and development (Quesenberry et al., 2016).

Parents and teachers can adhere to the rules for utilizing technology in early childhood that are provided by the AAP and NAEYC. It is feasible to strike a balance between using technology with young children in the school and at home.

As outlined in the background of this study, technology plays a very crucial role in learning of mathematics activities in early year's education. Technology improves the learning outcomes of the learners at this early stage of the learners' life. However, majority of earlier research on the use of technology has put very little emphasis on early year's education. Most studies in education were conducted at higher levels of education, such as secondary schools, teacher colleges, and universities, ignoring the Early Years Education (EYE), which is the fundamental base upon which subsequent levels are built.

For instance, Makori (2012) conducted research on the use of ICT in education and training of undergraduate library and information science students at Kenyan institutions; his paper's purpose was to analyse and illustrate the extent to which African university libraries are using web 2.0 systems to close the information gap, taking into account both the opportunities and obstacles. Similarly, Irarua (2014) investigated the sustainable deployment of ICT in secondary schools in Nairobi County while Chemwei (2013) conducted research on the variables affecting teacher teachers' use of ICT in the classroom in Kenyan primary teacher training institutions.

Other studies, such as the one by Ondimu (2018), dealt with teachers' readiness for CBC implementation, not ICT integration for CBC implementation, which is the primary subject of this study. There is a vacuum that has to be addressed by current research since the use of technology in Early Years Education to maximize learning outcomes is not given enough consideration (EYE). In order to optimize learning outcomes in early year's education, this study will examine the influence of technology (including the accessibility of ICT resources, the attitudes of educators, their professional growth, and assistance in optimising learning results).

2.7 Summary

The chapter generally has looked at the general review covering the concepts of integration mathematics activities in early year's technology and its impact on learning outcomes in mathematics activities. This is from the international to the local level. It has looked at the issues in line with the study objectives which are; how adequately technology is used in teaching mathematics activities in EYE; the teachers' competency in teaching mathematics activities in EYE using technology; teachers' attitude towards using technology in teaching mathematics activities and the teaching methods used by teachers in teaching mathematics activities in EYE using technology. All these have been compiled and with the related studies, chapter two of this study is complete. It therefore has ushered us in to the third chapter which looks at the research design methodology.

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

This study explores the teachers' integration of technology in teaching Mathematics in EYE in Bungoma county, Kenya. This chapter describes the research paradigm, the research design, location of the study, target population, sample population and sampling procedures, data collection procedure, data collection instruments, validity and reliability of research instruments, data collection instrument validity and reliability, data presentation and analyses as well as ethical considerations by the study.

3.2 Philosophical Paradigm

According to Creswell (2007 p47), a "philosophical paradigm" is a way of viewing and interpreting the world and the subject of research. According to Willis (2007), "the paradigm is therefore a systematic set of values, a world view, or a framework that leads research and activity in the subject." This research is based on pragmatism philosophical paradigm. Researchers that use a pragmatic approach concentrate on the "what" and "how" of the study challenge (Creswell, 2011). While pragmatism is thought to be the paradigm that provides the basic philosophical foundation for mixed methods research, this paradigm considers "the research topic" as key and applies all methodologies to solving the problem (Tashakkori & Teddlie, 2003; Somekh & Lewin, 2005). This research paradigm is pertinent to this study because it is problem-centered, pluralistic, practice-oriented, and adaptable with the use of a mixed model. It also addresses the effects of actions.

The research is dealing with teachers' competency in the use of technology in teaching mathematics activities in EYE, teachers' attitude towards the use of technology in teaching Mathematics activities in Early Years Education, establishment of how

adequately technology is used in teaching mathematics activities in EYE, teachers' teaching methods in teaching mathematics activities in EYE using technology. It is therefore based on this that the researcher has to answer the questions about how and what is being done to integrate technology in the curriculum. The method of gathering data involved questionnaires, observation schedules and experiments.

3.3 Research Design

The study adopted a convergent mixed methods design, which is sometimes referred to as a concurrent or parallel mixed methods design. This design enables a researcher to obtain a more comprehensive and validated understanding of a phenomenon by collecting quantitative and qualitative data simultaneously and then integrating the findings for comparison, (Katz-Buonincontro, 2024). In this approach, both forms of data are given equal priority, analyzed separately, and merged during interpretation to generate richer and more reliable conclusions than either method alone (Creswell & Plano Clark, 2018).

A convergent mixed methods design was particularly suited for this study because it allowed the researcher to combine measurable trends such as competence scores, teacher attitudes towards technology, availability of technological tools and technological methods used teaching mathematics activities with in-depth explanations The design makes it possible to validate quantitative results using qualitative insights, or to explain qualitative patterns using numerical trends. As Creswell and Plano Clark (2018) highlight, the intent of integration in a convergent design is to develop results that expand understanding, enhance comprehensiveness, and strengthen confirmation across datasets. Fàbregues et al. (2020) further emphasize that convergent studies are particularly appropriate when the researcher intends to interpret findings at the same time, since both data outputs become available concurrently.

The researcher selected this design for several reasons aligned with the study objectives on the integration of technology in teaching mathematics in Early Years Education (EYE):

On the objective to assess teachers' competence in integrating technology in mathematics activities, Quantitative data from teacher questionnaires measured competence levels, while qualitative interviews provided deeper insights into how teachers acquired technological skills, the types of digital tools they used, and challenges faced. The convergent design allowed the researcher to confirm whether the numerical competence scores from the teachers of EYE aligned with the head teachers' narrated experiences and practices

Similarly on the objective to examine teachers' attitudes toward using technology in teaching mathematics, the study required both numerical indicators of attitude for instance the Likert-scale measures and qualitative explanations which were reasons for positive or negative attitudes. By comparing the two datasets, the researcher was able to identify whether the attitudes expressed in interviews supported or contradicted the quantitative trends, thereby enhancing the validity of the findings.

The same trend was followed in the third objective which sought to determine the adequacy of technological tools available in EYE classrooms. Quantitative data provided measurable indicators such as the number of devices per class, ratio of learners to devices, and frequency of use. Meanwhile, qualitative data revealed contextual issues such as accessibility and teacher preferences that numbers alone could not capture. The integration of both datasets created a more accurate picture of the technology environment in Bungoma County EYE centres. The statements exhibited in the

interview schedules created a more evident picture of the adequacy of technology in EYE centers.

On the fourth objective which was to explore the influence of teaching methods on the integration of technology in teaching mathematics activities in EYE in Bungoma County, while questionnaires helped quantify the extent to which teachers used technology-supported instructional approaches, interviews and classroom explained why certain methods were preferred and how they were implemented. A convergent design enabled the researcher to triangulate methodological practices across data types.

The study followed the standard procedures of a convergent mixed methods design as outlined by Creswell and Clark (2018). To begin with, it Simultaneously Collected data. Quantitative data was collected using questionnaires from the teachers of EYE while qualitative data was attained from head teachers by using interview schedules. were collected within the same timeframe. This ensured that both datasets reflected the same teaching and learning conditions in the EYE centres. Thereafter, Separate Analysis of Each Dataset. Quantitative data were analyzed using descriptive and inferential statistics to reveal patterns in competence, availability of technological tools, teachers' attitudes, and teaching methods. Qualitative data on the other hand was analyzed through coding and thematic analysis to capture experiences, perceptions, and contextual factors influencing technology integration.

Further, Merging and Comparing Results was done. After separate analyses, the researcher compared the quantitative and qualitative findings through narrative discussions. This allowed for identification of Convergence that is findings that supported each other, complementarity; findings that expanded understanding and divergence contradictory results requiring further interpretation.

Given the complexity of integration of technology in teaching mathematics activities which involves human factors such as skills and attitudes, resource factors like the availability of tools, and pedagogical practices, the convergent design provided a balanced and efficient way to address all research objectives within a limited timeframe. As Creswell and Plano Clark (2018) note, this design is advantageous when the researcher has the capacity to manage both data types and when comprehensive insights are needed despite time constraints. Additionally, the simultaneous approach ensured that the reality in Bungoma County EYE centres was captured holistically and interpreted understandably.

3.4 Location of the Study Area

The study was conducted in Bungoma County. The size of Bungoma County is around 3,032 km^2. It is situated on the southern slopes of Mount Elgon, which also serves as the county's highest point. Trans Nzoia County to the North East, Kakamega County to the East, Busia County to the west. It is located in Kenya's former Western Province. Bungoma Town is the county's capital. Bungoma County has a population of around 1,650,750 people; 806,000 male and 844,593 female. By 2025, the population is expected to rise to 1,751,454; 856,916 men and 894,538 women. In order to create Bungoma County in 2010, the nearby Mt Elgon District was dissolved, and its holdings were merged with the then Bungoma District. The county is divided into nine sub-counties, with Webuye West being the biggest: Bungoma Central, Bumula, Kimilili, Bungoma South, Bungoma West, Bungoma North, Mt Elgon, Webuye East, and Webuye West. The county, like all other counties, has made great efforts to prioritize education. There are 868 elementary schools and 212 secondary schools, both public and private, which make up the 1080 schools in Bungoma County.

It was vital to conduct this study on ‘integration of technology in mathematics activities in order to see its implications to classroom instruction in early year’s education.’ This is meant to investigate how integration of technology might help early-childhood teachers maximize learning given the rapid global growth of technology. The modern classroom is a combination of digital technologies that are gradually being infused into the traditional pedagogies with varying degrees of notable success. However, it is important to note that according to a study by Wafula (2014), Bungoma County was seen to be slow in adopting basic computer literacy and awareness in teaching and learning and was ranked the 42nd out of 47 counties in Kenya. This clearly shows the gap. The study is vital by the fact that the country needs strategies on improving the use of digital technologies in classroom instruction.

3.5 Target Population

Zikmund et al., (2010) describes a population as any set of particular groups of individuals or non-individuals, such as artifacts, educational institutions, time units, geographical areas, wheat prices or salaries for individual; a list of the elements from which a sample can be drawn. In research, the most critical stage is the selection of a population. The term population in a statistical context refers to the number of the individuals or objects under analysis (Babbie, 2001). The study target group was teachers of Early Years learning in public primary schools, Head teachers and educational officers. In Bungoma County, there are 884 basic education centers in public primary schools and 1,768 teachers in public primary schools of which, 884 are head teachers.

Table 3.1 Target Population

Targeted category	Target number
Head teachers	884
EYE Teachers	1768
Total	**2652**

Source: Bungoma County (2022)

3.6 Sampling Techniques and Sample Size

Sampling involves making conclusions about populations from the samples using a certain part of the population (Zikmund et al., 2014, Depoy & Gitlin 2011). Kothari (2008) notes that the researcher should select the sample size that is capable of giving enough population information and that is easy to analyze. The study used random sampling where the investigator made a random sample without a complete listing of each individual. The random sampling technique simplified the sampling process and increase fieldwork efficiency (Kothari, 2006).

This study therefore used the simple random sampling to obtain 177 EYE teachers from clusters in nine sub-counties in Bungoma County (10% of 1768) and purposive sampling to get 9 head teachers each being in charge of one primary school housing an EYE centre.

Table 3.2 Sampling Frame

Public primary schools	Head teachers purposively sampled	EYE teachers randomly sampled	Total sample size
884	88	177	265

Source: Bungoma County (2022) and Researcher (2024).

3.7 Data Collection Instruments

The data collection instruments are stated and discussed in this section. The instruments include: a set of questionnaires for the teachers of EYE. The other key instrument that was used was interview schedule for the head teachers. The interview schedules are meant to compliment the questionnaires and in this case they are for the purpose of triangulation. This enhanced reliability and validity of the results. On the other hand, secondary data was gathered from publications by reviewing relevant published literature, such as text books, and journals articles.

3.7.1 Questionnaire

A list of questions asked in a logical order makes up a questionnaire. To obtain quantifiable data, a systematic questionnaire was distributed to the EYE teachers. Structured questions were utilised in the survey. A structured questionnaire is a document used to collect data from respondents that comprises a series of standardised questions with a predetermined format that details the precise wording and sequence of the questions. Bryman and Bell (2011) state that questionnaires are useful for gathering the data from respondents thought to be sample representative of a population. Bougie and Sekaran (2013) on the other hand states that a set of questionnaire are designed to ensure the respondent's occasioned information on the major issues are captured. In this study, the questionnaire was for the EYE teachers. The questionnaires was most appropriate tool since it allowed the researcher to reach out the respondents more easily. As affirmed by Kothari and Gang, (2014), they facilitate easy and quick derivation of information needed. Each item of the questionnaire was developed to address the four objectives outlined in this study.

The questionnaire for the teachers of EYE sought to provide the bio-data which included gender, age, qualification, experience, leadership skills among others. The tool

also sought to find out information in line with the objectives as stated in the study which included the competency of EYE teachers in the integration of technology in teaching Mathematics activities, the attitude of the teachers of EYE towards the use of technology in teaching mathematics activities, the adequacy in the use of technology in teaching mathematics activities and finally methodology applied in the use of technology in the teaching of mathematics activities. This questionnaire had both open and closed ended questions. The open-ended questions were used since they are easier to analyze. This is because are already in their usable form, easier to administer and are economical to use. On the other hand, closed-ended questionnaires gave the respondents total freedom to respond in their own way (Mugenda, 2008). The study was banking on the open-ended responses since these responses gave insight of what is happening on the ground. The researcher was able to establish the teachers' use of technology, their interest in the use of technology and their motivation to teaching mathematics activities.

The questionnaire for the EYE teachers comprised of four sections. **Section A** gave the bio-data for both respondents, **Section B** was on the adequacy of use of technology by the EYE teachers, **Section C** was on the competency of teachers of EYE in the use of technology, **Section D** was on the attitude of the EYE teachers on the use of technology and finally section E was on the methodologies that were used in teaching learners of EYE with the use of technology. All these sections were in line with the study objectives. The questionnaire was distributed to the respondents using the drop-and-pick approach. This also guaranteed the respondents their privacy and ample time in answering the questions.

3.7.2 Interview Schedule

The interview was specifically for the head teachers. According to Kothari and Gang, (2014), this is an administration of questions which involve face-to-face interaction. This is a form of qualitative research in which the opinions of people are sought and recorded. In contrast to using a questionnaire, using an interview schedule allowed the researcher to ask the interviewees questions and provided data that was more rich (Frankel, Wallen & Hyen 2012). The head teachers of selected schools were the most suitable to give first-hand information on the use of technology in curriculum and verification of their responses were done by administering a questionnaire to the teachers of EYE and further through lesson observation of the EYE teachers. The head teachers were key people since they were thought to be most knowledgeable and participated in policy making.

According to Lindlof & Taylor, (2015), Scheduling interviews can improve the validity and dependability of the information acquired. The interviewers prepare the questions in advance, and the responses are supposed to be well-considered and possibly accurate. Because they can ask follow-up questions or explanations to the prepared questions, it enables researchers and interviewers to obtain more information. The information given may be relevant and useful. Further, they also believe the rate and number of responses are higher. The interviews are normally done within some stipulated time thus the interviewers come prepared and use the time given.

However, Lindlof & Taylor, (2015), state that the interview schedules are also time consuming. They require a lot of time for preparation before they are used. They can suffer bias of the interviewer in the case that the interviewer is not very professional. Similarly, there could be high variability when the schedule is used by multiple interviewers. The research evaded these challenges by being as professional as possible

and by ensuring that the interviews were carried out with minimal assistance from the research assistants.

Structured interview schedule were used in this study. This type of interview schedule is often compared with the format used in questionnaires because of their similarities. Whereas the questionnaires were just completed by the respondents, who were EYE teachers, the interview schedule was utilised by the interviewer during a face-to-face encounter. The questions that were to be asked and the interviewer's notes on the responses were both included in the interview schedule. For a structured interview, creating an interview schedule is essentially the same as creating a questionnaire. It's just that the questionnaire will be used solely by the interviewer, and the respondent or interviewee will not get to lay their eyes on the contents. However, while creating their interview schedule, some interviewers blend the characteristics of these two types for greater flexibility. It would really be up to the interviewer, and what he deems to be most effective in achieving his objectives

According to Lindlof & Taylor (2017), interview schedules increases reliability and credibility of gathered data. They state that because they can ask follow-up questions or explanations to the prepared questions, it enables interviewers and researchers to obtain additional information. Additionally, an interview schedule makes it easier to do an interview because the questions are pre-prepared, making it simpler to conduct and finish the interview. It also increases the likelihood of collecting accurate data since questions which were already prepared beforehand. Flexibility and high Customization is another advantage as stated by Landlof and Taylor. They are used when interviewing different types of people. Normally the interviewer prepares it with the respondents in mind. Often, interviews are time-bound. They are given only a limited amount of time to ask all their questions and get the answers.

However, interview schedules have their own limitations; they are time-consuming particularly for comprehensive or in-depth interviews, they have a high risk of Subjectivity stemming from the interviewer's discretion in selecting the questions posed during the session and could have high variability potentially yielding unreliable information during the interview process, (https://buddingsociologist.in/interview-schedule).

In this study, the questions in the interview schedule, were in line with the research objectives. which were on the adequacy of use of technology by the EYE teachers, the competency of teachers of EYE in the use of technology, attitude of the EYE teachers on the use of technology and finally on the methodologies that are used teaching learners of EYE with the use of technology.

3.8 Pilot Study

A pilot study is important because it helps a researcher determine whether the research instruments are valid, reliable, and appropriately designed for the main study. In this study, piloting of the tools was carried out in Busia County, which borders Bungoma, among EYE learning centres. Piloting was done to ensure that the research instruments for used in this study were effective. Through the pilot exercise, the researcher was able to identify and rectify potential flaws in the design, language clarity, arrangement, and administration procedures of the tools. As noted by Cooper and Schindler (2014) and Cohen, Manion and Morrison (2017), piloting enables the detection of tools and design weaknesses. It also ensures correct data collection methods, and enhances the reliability and validity of tools of data collection. In this case, it ensured that the questionnaires of used to collect data from teachers of EYE and interview schedules for the head teachers were valid and reliable. Consistent with Mugenda and Mugenda (2007), the data

collected during the pilot was checked for accuracy, consistency, and reliability, confirming that the instruments were suitable for use in this research study.

3.9 Validity and Reliability of the Research Instruments

This section discusses validity and reliability of the instruments. It is a very important aspect in any study since the tools were tested before they are used for data collection. The prior testing of the tools ensured that the results attained are valid and reliable. The results can at this point be referred to or depended upon. This in itself showed that the piloting stage was very important.

3.9.1 Validity of the Research Instruments

Validity is quite essential for ensuring that research is accurate, trustworthy, and meaningful. Mugenda and Mugenda, (2007) states that, validity is the degree to which obtained results for analysis are representative of the phenomena under study. In this case the variables under study are accurate. According to Kothari (2004), validity is the extent to which a measuring instrument captures what it is supposed to capture, or more precisely, the extent to which differences detected by a measuring instrument reflect actual differences among test subjects. The supervisor analyzed the questionnaire to increase the validity of the instruments and determine if the questions accomplished the research objectives and provided answers to the research questions. In order to get the validity of the instruments, the research ensured that it looks at the quality and credibility of the research data and methods. The research ensured that data and methods that were selected were reliable so that the results could be replicated and generalized. According to Patton, (1999), in qualitative research, triangulation is the process of using several techniques or data sources to create a thorough understanding of a phenomenon. Triangulation, a qualitative research technique, was applied in this study to combine data from several sources and test validity. The material came from

a variety of sources, including the internet, papers, and earlier research. A questionnaire and an interview schedule served as the data gathering instruments. These tools were meant to address the same research objectives and questions. They complemented each other and therefore ensured that the responses carried more weight. This research chose to look at Criterion-related validity. This kind of validity endears to compare results of a particular tool to another. Further this validity shows that data gathered by one instrument link highly with one another. This meant that data collected using questionnaire agreed well with data from interview schedule.

To wind up, internal validity was also of interest. The validity was meant to seek the explanation of particular event. It was meant to ascertain accuracy which could be applied to qualitative and quantitative research. The findings accurately explained the phenomena being researched in this case the integration of technology in mathematics curriculum and its implication to classroom instruction in Early Years Education in Kenya.

3.9.2 Reliability of the Research Instruments

A research tool's reliability is determined by how consistently it produces data or outcomes after several trials (Babbie 2014). A researcher's tool is regarded to be reliable when it satisfies the aforementioned requirements. In other words, a tool is said to be reliable when it is dependable upon being used repeatedly. No matter the setting, it may be used several times and produce comparable results. The reliability of the teacher's questionnaire was evaluated using the pilot study findings. The respondent was given the questionnaire based on the two sets of scores that were acquired using the Pearson's products moment correlation approach. Since the coefficient was more than 0.75, the reliability was good as suggested by Sreevidya and Sunitha (2011).

3.10 Data Collection Procedures

Through the dean of the school of education at Moi University, the researcher applied for approval from the National Council for Science, Technology, and Innovation (NACOSTI) which granted a research permit. After then, the researcher visited the field that is the schools in the county that was chosen at random. The researcher got in touch with the Head Teachers of the chosen schools. The researcher gathered information by asking teachers who were chosen at random from each school to fill out questionnaires. Each instructor was asked to complete surveys anonymously, without consulting their coworkers or writing their names on them. The usage of questionnaires was favored since they allowed the researcher to get a lot of data quickly and efficiently while saving time (Kothari, 2014). On the other hand, the head teachers of the selected primary schools in which the EYE centers are situated had an opportunity to respond to questions which were posed to them through an interview with the researcher. The researcher had questions that guided him. The researcher noted the responses which were later used as a basis for his findings. Further the researcher also had a checklist which formed the basis of his observation. Apart from the questionnaires and the interview schedules, the researcher also observed keenly the environment in the classrooms the school in general to ascertain the presence of ant technological gadgets. This included keen observation of the teachers on how they carried out interactions and whether their lessons were accompanied by the technology tools stated or not.

3.11 Data Presentation and Analysis

Data must be packed and formatted so that its key components may be analyzed through data analysis in order for it to be successfully and simply presented. This implies that following fieldwork, the dependability of the questionnaires was thoroughly examined, and verification was completed prior to data processing. The study's objectives were

taken into account while doing theme analysis on qualitative data, and a narrative presentation was made. Descriptive and inferential statistics was used to organize and interpret quantitative data.

3.12 Ethical Considerations

Below is a refined, explicit statement of the ethical procedures for the study titled "Teachers' Integration of Technology in Teaching Mathematics Activities in Early Years Education (EYE) in Bungoma County." The section incorporates informed consent, confidentiality, voluntary participation, institutional approvals, avoidance of deception, protection from harm, and dissemination of findings. In conducting the research "Teachers' Integration of Technology in Teaching Mathematics Activities in Early Years Education (EYE) in Bungoma County," the researcher adhered to established ethical principles as outlined by Cohen, Manion & Morrison (2017), Cooper & Schindler (2014), and Bryman & Bell (2011). The research therefore explicitly looked at the following:

Informed and Voluntary Consent was one of the ethical issues that came up in this study. All potential participants were fully informed about the purpose and objectives of the study, the procedures involved, any potential risks or benefits, and their rights, including the right to ask questions and the right to withdraw at any stage without penalty. Participants were only included in the study after they provided voluntary informed consent, free from coercion, pressure, or inducement. The consent document reflected the principle of autonomy and clearly indicated that participation was optional and that refusal to participate would carry no negative consequences.

One other issue that was put into consideration was Institutional and Governmental Approval. Prior to data collection, the researcher obtained an official authorization

letter from the School of Education, Moi University, a research permit from the National Commission for Science, Technology and Innovation (NACOSTI), approval from the County Commissioner of Bungoma where research was being conducted and permission from the County Director of Education in Bungoma County. These approvals ensured that the study complied with national and institutional regulations regarding research involving human participants.

Confidentiality and Anonymity was the other key aspect that was given preference in this study. This was meant to protect participants' privacy. Data collection was conducted through official, pre-approved tools and procedures, ensuring no unauthorized access to sensitive information. Participants' names, school identities, or any personal identifiers were not recorded in the research report. All data was stored securely, and access was restricted to the researcher alone. Findings were reported in aggregate form, ensuring that no individual participant or school could be identified. This upheld the ethical obligation to respect the dignity and privacy of all participants.

The researcher also had a duty to build Trust and Respect from the respondents. Once in the field, the researcher established rapport with teachers of EYE in respective schools and school administrators (the head teachers). The researcher assured them of non-judgmental and non-threatening engagement, and conducted all interactions with respect and professionalism. This approach helped participants feel comfortable, promoting openness and honest engagement in the study. Teachers of EYE on the one hand felt acknowledged and valued thus were willing to share information. The researcher on the other hand chose the Avoidance of Deception. The researcher did not withhold any material information or mislead participants at any stage. The purpose, methods, and intended use of the data were truthfully stated throughout. In line with

Cooper & Schindler (2014), the study upheld honesty and transparency, ensuring that no form of deception was used to obtain data from the respondents.

Further, this study also upheld the ethics of Protection of respondents from Harm. Participants were protected from physical harm, psychological stress, professional risk, or any form of discomfort associated with participation. All procedures were designed to ensure that teachers could participate without disruption to their professional responsibilities or personal safety. The questionnaires were completed at the participants own convenience, none of the participants was forced or hurried in any way to respond. The researcher was willing to go back again and again so long as one was willing to participate but at their convenience. Respondents also had the right to Withdraw. They were informed that they could withdraw at any point, without giving a reason, and without any consequence to their employment or relationship with the researcher. This reinforced respect for autonomy and voluntary participation.

It was also the duty of the researcher to ensure accessibility to Study Findings. Upon completion of the study the findings were shared with relevant authorities, including school administrators and education officials, and were made available to any participant who expressed interest in knowing the results. This ensured transparency and accountability in the dissemination of research outcomes.

3.13 Chapter Summary

This chapter has included a comprehensive description of the study design and methods. The target population for the particular region of research and the sample techniques are described in detail. Additionally, information on the tools used for data collecting as well as the ways it was presented has been discussed. The questionnaire, interview schedule, and observation schedules were the three data collection methods used in this

study. These methods were also emphasized and explored in the research. Piloting of the research instrument as well as its validity and reliability has also been covered in the study. The chapter has examined the ethical issues in its last section.

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS, INTEPRETATION, AND DISCUSSION OF FINDINGS

4.1 Introduction

This chapter presents the results of the research that was conducted. First, it provides the response rate. Secondly, it describes the general background information of the respondents and descriptive analysis of the study variables. Finally, the chapter describes the results of statistical analysis and at the same time presents the discussions of the results and conclusions from the findings. Where Likert scale was used, Strongly Disagreed (SD) and Disagreed (D) were combined to Disagreed (D) Neutral (N) while Agreed and Strongly Agreed (SD) were combined to Agreed (A).

4.2 Response Rate

Table 4.1 Response Return Rate

	Frequency	**Percentage**
Respondent	143	80.8
Non-respondent	34	19.2
Total	**177**	**100**

Bryman and Bell, (2011), states that, response return rate in data collection refers to the percentage of individuals from a sample who actually complete and return a survey or questionnaire, essentially representing the proportion of the target population that provided data for the study. According to them, a response rate of 70% or higher is considered exceptional, a rate of 60% is decent, and a rate of 50% is sufficient for analysis and reporting. Therefore, in line with this study, 80.8% response return rate can be termed excellent. This response rate was adequate for analysis, reporting and making of conclusions and recommendations regarding the integration of technology

in mathematics curriculum and its impact in teaching mathematics activities in Early Years Education in Bungoma County, Kenya, based on the specific variables engaged in this investigation. The study considered EYE teachers and head teachers of public primary schools. The study sampled 177 respondents and managed to collect data from 143 respondents. This represented 80.8 per cent response rate. This was quite good since it was an affirmation by Saleh and Bista (2017) who noted that a response rate of more than 75% is appropriate for data analysis

4.3 Background Information of the respondents

The study sought to establish the general information of the respondents. This information included establishment of: Gender, Age Bracket, Education level and Work Experience of the respondents. The study results were as follows:

4.3.1 Distribution of EYE teachers by Gender, Age bracket and Education level and work Experience

From the table, the study findings on the gender of the respondents showed that 86 (60.0%) of the respondents were male while 57 (40.0%) were female. This shows that the study managed to collect data from both gender and thus their opinions were represented in the study. From this data, it could be true to state that both genders are available at the EYE. These results nullify the belief that EYE is meant for female teachers alone. It could also mean that both genders have embraced that one can work at any level and this a positive attitude.

Secondly, the study results revealed that majority of the respondents were aged 36-45 years representing 62 (43%). 55 (38%) of the respondents were aged between 26 and 35 years. 23 (16.3%) of the respondents were aged between 46 and 60 years while. Lastly 3 (2.0%) of the respondents were aged 25 years and below. This implies that the

study managed to collect data from all the age brackets captured in the study. From the table, it could also be true to state that majority of the teachers in EYE are adults. It could also mean that many EYE centres prefer adult teachers because they are patient and can handle young learners with a lot of patience. Going by the percentage, very few young teachers, 4 (2%) were found to be teaching in EYE. There could be a number of factors making teachers below 25 years to be very few in EYE. Similarly, it could also be true to say the government is not employing the recently graduated EYE teachers

The study sought to determine the distribution of respondents by the highest level of education and the results were as presented in the table above. The study findings on the education level of the respondents indicated that 86 (60.2%) of the respondents were diploma holders while 57 (39.8%), respondents were certificate holders. Further, it could also be true to state that the country is investing much in education thus many teachers are being trained to handle young children. Lastly it could also imply that there is competency in curriculum delivery at this level; the EYE teachers could be updated with the new development in EYE especially with the CBC which is the in thing in Kenya's education system. Learners seemingly are being handled by qualified and professionals.

On level of education therefore, it is true to say that teachers in EYE are well trained and qualified to handle learners at this level since they are in possession of diploma and certificate qualifications.

The study results on the work experience of the respondents indicated that 15(10.8%) of the respondents had served for less than 5 years, 63 (43.8%) had served for 6-10 years whereas 65 (45.4%) of the respondents had served for over 11 years. This implies that majority of the respondents had served for over 10 years not ignoring the middle

bracket of 6-10 years. From the above, it could be true to say that most of the teachers of EYE are experienced and are aware of the need of EYE. The small percentage of the teachers who have taught for less than 5years; 15 (10.8%) is evidence that there could be effort to inject new skills in handling the EYE learners and thus an added advantage in handling the CBC.

The study sought to establish the distribution of respondents by gender age bracket and level of education. These findings are shown in table 4.2 below.

Table 4.2 Gender, Age bracket, Education level and work Experience of teachers of EYE

Gender	Frequency	Percent
Male	86	60.0
Female	57	40.0
Total	**143**	**100.0**
Age Bracket	Frequency	Percent
Less than 25 years	3	2.0
26-35 years	55	38.0
36-45 years	62	43.0
46-60 years	23	16.3
Total	**143**	**100**
Education Level	Frequency	Percent
Diploma	86	60.2
Certificate	57	39.8
Total	**143**	**100**
Work Experience	Frequency	Percent
Less than 5 years	15	10.8
6-10 Years	63	43.8
Over 11 Years	65	45.4
Total	**143**	**100**

4.3.2 Distribution of Head Teachers by Gender, Age Bracket, Education Level and Work Experience

From the table 4.3, 60 (68%) of the head teachers were male while 28 (32%) of the respondents were female. This means that data for the head teachers was collected from

both genders. This could mean that headers of primary schools in Bungoma County are of mixed gender although there are more male than female. In term of age bracket, 10 (11.4%) of the respondents were between 26-35year, 40 (45.5%) of the respondents were between 36-45 years and 38(43.1%) were between 46-60 years. This shows that majority of the head teachers are adults and mature enough to handle the schools. It could also mean that majority of the head teachers have enough experience to be heads of schools. However, the few that are below 36 years are a testament that head teachers are not only considered by age but could be qualification. It could also mean that new skills are injected in leadership by the young leaders.

The study also sought to find out the education level of the head teachers. 30 (34.1%) of the respondents were diploma holder and 58 (65.9%) of the respondents were certificate holders. This shows that in terms of education, head teachers of primary schools in Bungoma County are trained. They are therefore in a better position to handle matters of administration. The last aspect of the Bio-data of head teachers sought to establish work Experience of the head teachers. The outcome was 8 (9.1%) of the respondents said they had worked between 6-10 years and 80 (90.9%) had work experience of 11years and above. These findings are shown in table 4.3 below.

Table 4.3 Gender, Age bracket, Education level and work Experience of Head Teachers

Gender	Frequency	Percent
Male	60	68.0
Female	28	32.0
Total	**88**	**100.0**
Age Bracket	Frequency	Percent
Less than 25 years	0	0.0
26-35 years	10	11.4
36-45 years	40	45.5
46-60 years	38	43.1
Total	**88**	**100**
Education Level	Frequency	Percent
Diploma	30	34.1
Certificate	58	65.9
Total	**88**	**100**
Work Experience	Frequency	Percent
Less than 5 years	0	0.0
6-10 Years	8	9.1
Over 11 Years	80	90.9
Total	**88**	**100**

4.3.3 Teachers' Competency in Teaching Mathematics Activities in EYE

Descriptive statistics are used to describe the basic features of the data in the study. They provide simple summaries about the sample and measures, (Trochim, 2006). This section represents the results of the study in form of tables and it also presents the descriptive analysis based on each variable. The respondents were asked to indicate whether they agree or disagree on the statement based on a Likert scale of 1 to 5 where 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree.

The first objective of the study sought to assess teachers' competence in teaching mathematics activities in EYE in Bungoma County using technology. The study's findings were as tabulated in table 4.4 below.

Table 4.4: Teachers' competency in teaching mathematics activities in EYE using technology

Statements		SD	D	N	A	SA	Total	Mean	Std. Dev.
I am knowledgeable in accessing and using content loaded on interactive whiteboards	F	7	12	23	61	40	143	3.80	1.047
	%	5	8.6	15.8	42.4	28.1	100	76.0	
I am adequately trained in using school tablets for teaching mathematics activities	F	7	17	20	56	43	143	3.79	1.074
	%	5	12.8	14.4	39.6	30.2	100	75.8	
I have the expertise in the use of hand-held gaming apps in teaching mathematics activities	F	0	3	20	89	32	143	4.04	0.342
	%	0	2.2	13.7	61.9	22.3	100	80.8	
I have expertise to use a tablet in teaching mathematics activities	F	7	11	25	40	60	143	3.93	0.346
	%	5	7.9	17.3	28.1	41.7	100	78.6	
I have enough skills in using educational apps in teaching mathematics activities.	F	0	3	21	62	57	143	4.18	0.591
	%	0	2.2	15.1	43.2	39.6	100	82.6	
I find It easy to use technological tools in teaching mathematics activities in EYE.	F	7	7	16	60	53	143	4.00	0.577
	%	5	5	11.5	41.7	36.7	100	80.0	
I have adequate training on controlling what leaners access in using technology while learning mathematics in EYE.	F	0	0	5	48	90	143	4.15	0.404
	%	0	0	3.6	33.8	62.6	100	83.0	
I am able to browse and download pictures that can be used in teaching mathematics activities in EYE.	F	7	7	12	49	68	143	4.14	0.010
	%	5	5	8.6	33.8	47.5	100	82.8	

The objective on teachers' competency in teaching mathematics activities in EYE had a number of items that were interrogated. On the item whether the teachers of EYE were knowledgeable in accessing and using content on interactive whiteboard, 19(13.6%) of the respondents disagreed, 23(15.8%) of them were neutral, 101 (70.5%) Agreed which had a mean of 3.8 and a standard deviation of 1.045. On whether the

teachers of EYE are adequately trained in using tablets for teaching mathematics activities, 24 (19.8%) of the respondents disagreed, 20 (14.4%) of the respondents were neutral and 99 (69.8%) of the respondents agreed. This translated to a mean of 3.79 and standard deviation of 1.074. On whether or not the teachers of EYE had expertise in the use of hand-held gaming apps in teaching mathematics activities, 23(15.9%) disagreed, 89(61.9%) were neutral, and 32(23%) agreed which transcribed to a mean of 4.04 and standard deviation of 0.342. Further, on whether teachers of EYE to had expertise to handle a tablet in teaching mathematics activities, 18(12.9%) of the respondents disagreed, 25(17.3%) of the respondents were neutral while 100(69.1%) of the respondents agreed, which translated to a mean of 3.93 and standard deviation of 0.346. On whether teachers of EYE had adequate skills in using technological apps in teaching mathematics activities in EYE, 24 (17.1%) of the respondents disagreed, 21 (15.1%) of the respondents were neutral, 117 (82.8%) of the respondents agreed. This was a mean of 4.18 and std. dev. of 0.59. Finally, on whether there were teachers of EYE that found it easy to use technological tools in teaching mathematics activities, 14(10%) of respondents disagreed, 12 (8.6%) of the respondents were neutral while 117(81.3%) of the respondents agreed. This transcribed to a mean of 4.00 and a standard deviation of 0.577.

From the above analysis, it is clear that majority of the teachers of EYE had the skills in using technological tools in teaching mathematics activities as supported by 117(82.%) of the teacher who agreed that they had adequate skills in using technological apps in teaching mathematics activities in EYE, 117(81.3%) of the respondents found it easy to use technological tool in teaching mathematics activities and 101 (70.5%) who agreed were knowledgeable in accessing and using content on interactive whiteboards. In agreement with this findings, the interviewed head teachers

said that teachers of EYE in their schools had basic knowledge about the use of technological tools in teaching mathematics activities. Majority of the teachers of EYE in Bungoma County are trained in using the technological tools meaning that they had the basic technological skills and had the expertise in the use of technological tools in teaching mathematics activities in EYE. Further, teachers had been integrating technological tools in teaching mathematics activities. However, a few of the teachers of EYE disagreed that they had the skills in using technological tools in teaching mathematics activities as supported by 24 (19.8%) who said that teachers of EYE had adequate skills in using technological apps in teaching mathematics activities and 23(15.9%) who said that teachers of EYE had no expertise in the use of hand-held gaming apps in teaching mathematics activities.

In agreement with the above findings, studies indicate that teachers' digital competencies are often developed through the means of Teacher Professional Development (TPD) programs that utilize co-creation related social processes (Prieto-Alvarez et al, 2018). While providing teachers with knowledge and skills about certain STEAM approaches or technologies (Herranen et al., 2021). In such training programs, experts of various domains (e.g., technology, pedagogy, and learning content combine their knowledge in order to provide participants with in-depth knowledge about using the selected technologies in the context of teachers' everyday teaching routines (Leoste, 2021). The co-creation approach relies on the ideas about user innovation, where end-users are involved in co-creation of innovation-related artifacts (in the context of education: teaching methods and relevant materials, related to various educational digital technologies), leading to higher user motivation and better innovation adoption rates (Von Hippel et. al., 2018; Bradonjic et al., teachers of EYE had adequate skills in using technological apps in teaching mathematics activities 2019). According to KICD

(2023), digital literacy is one of the key competencies for Competency Based Curriculum (CBC) in Kenya. Imagination and creativity, critical thinking and problem solving, and communication and teamwork are the other essential skills. One of the goals of the EYE learning outcomes is to use digital literacy for learning and enjoyment. Additionally, it claims that children with digital literacy are creative, articulate, analytical, and problem-solving. These students are able to ethically use digital media for learning and personal development, interact with various audiences and finally, are able to use and apply technology in learning.

This can also be well elaborated through the theoretical framework (TPACK) which illustrates the aspect of Content Knowledge, (CK). Content Knowledge (CK) is defined as teacher knowledge about a particular subject matter and how it is taught and learned. Shulman (2013) noted, CK would include knowledge of concepts, theories, ideas, organizational frameworks, knowledge of evidence and proof, as well as established practices and approaches toward developing such knowledge. & quote; for educators, effective content instruction that engages students in higher-order activities using authentic, real-world examples facilitated through technology is the cornerstone of teaching and learning in the 21st century. Thus, educators must not only be thoughtful in the instructional techniques they use to present content but also be strategic in the technology selected to teach the subject matter as it may result in positive or negative results in long-term learning and knowledge retention.

4.3.4 Teachers' Attitude towards the use of Technology in Teaching Mathematics Activities in EYE

The second objective sought to examine the effect of teachers' attitude towards the use of technology in teaching mathematics activities in EYE in Bungoma County. The study results were as shown in table 4.5.

Table 4.5: Teachers' attitude towards the use of technology in Teaching mathematics activities in EYE

Statements		SD	D	U	A	SA	Total	Mean	Std. Dev.
The use of technology in teaching mathematics activities is interactive	F	7	12	23	61	40	143	4.00	1.187
	%	5	8.6	15.8	42.4	28.1	100	80.0	
The use of technology makes understanding of mathematics concepts easy.	F	6	17	22	86	12	143	3.55	0.969
	%	4.3	12.2	15.1	60.4	7.9	100	71.0	
The use of computers has improved my efficiency in teaching mathematics activities.	F	6	17	21	86	12	143	3.55	0.764
	%	4.3	12.2	15.1	60.4	7.9	100	71.0	
Technology makes learners to learn mathematics activities through visualization.	F	15	24	29	72	3	143	3.16	0.606
	%	10.8	16.5	20.1	50.4	2.2	100	63.2	
Creativity is very high when learners use technology in learning mathematics activities	F	0	3	22	62	57	143	3.11	1.446
	%	0	2.2	15.1	43.2	39.6	100	62.2	
Use of technology enhances learner's communication in mathematics lessons	F	7	7	17	60	52	143	4.13	0.860
	%	5	5	11.5	41.7	36.7	100	82.6	
Use of technology in teaching mathematics activities enhances problem-solving skills.	F	0	0	5	48	90	143	4.12	0.936
	%	0	0	3.6	33.8	62.6	100	82.4	
Technology used in teaching mathematics activities in EYE has features that give learners immediate feedback	F	7	7	12	48	68	143	3.98	1.130
	%	5	5	8.6	33.8	47.5	100	79.6	
Teaching mathematics activities in EYE using technology engages the learners in the learning process.	F	10	21	40	52	20	143	4.12	0.764
	%	7.2	14.4	28.1	36.7	13.7	100	82.4	

The second objective of this study sought to establish the teachers' attitude towards the use of technology in teaching mathematics activities in EYE. On the item the use of technology in teaching mathematics activities is interactive, the results revealed that 19(13.6%) disagreed, 23(15.8) were neutral and 101(70.1%) agreed which translated to a mean of 4.00 and std. deviation of 1.187. On the issue, the use of technology makes

understanding of mathematics concepts easy, 23(16.5%) of the respondents disagreed, 21(15.1%) were neutral and 98(68.3%) of the respondents agreed translating to a mean of 3.55 and a std. dev. of 0.969. On the issue of the use of personal computers had improved their efficiency in teaching mathematics activities, 23(16.5%) of the respondents disagreed, 21(15.1%) of the respondents were neutral while 98(68.3%) agreed. This transcribed to the mean of 3.55 and a std. dev. of 0.764. On the matter technology, makes learners to learn mathematics through visualization, 39(27.3%) disagreed, 29(20.1%) were neutral and 75(52.6%) of the respondents agreed which translated to the mean of 3.16 and a std. dev. of 0.606.

On the issue creativity is very high when learners use technology in learning mathematics activities, the outcome was, 3(2.2(%) of the respondents disagreed, 22(15.1%) were neutral while 119(81.8%) of the respondents agreed which was a mean of 3.11 and a std dev. of 1.446. on the use of technology enhances communication in mathematics lessons, 14(10%) of the respondents disagreed, 12(8.6%) were neutral while 116(81.3%) agreed. This was a mean of 4.13 and a std. dev. of 0.860. Use of technology in teaching mathematics activities enhances problem solving skills elicited a response of 0 (0%) disagreeing, 5(3.6%) of the respondents being neutral and 138(96.4%) of the respondents agreeing which translated to a mean of 4.12 and a std. dev. of 0.936. On the issue, technology used in mathematics activities in EYE has features that give a learner immediate feedback, 14 (10%) of the respondents disagreed, 12(8.6) of the respondents were neutral and 116(81.3%) of the respondents agreed. This transcribed to a mean of 3.98 and a std. dev. of 1.1130. The last item was teaching mathematics activities in EYE using technology engages the learners in the learning process. The results were, 31(21.6%) of the respondents disagreed, 40(28.1%) were

neutral while 72(50.45%) agreed which translated to a mean of 4.12 and a std. Dev. of 0.764.

From the above analysis, it is comprehensible that majority of the teachers of EYE in Bungoma County had a positive attitude towards the use of technology in teaching mathematics activities in EYE. This is supported by 138(96.4%) who said that the use of technology in teaching mathematics activities enhanced problem solving skills, 119((81.8%) who agreed that creativity is very high when learners use technology in learning mathematics activities and 116(81.3%) who said that the use of technology enhanced communication in mathematics lessons among others. These responses were in agreement with the views of the head teachers who were interviewed. They agreed that lessons in EYE classes have been very interactive in their schools and that most of their teachers have been using personal computers to teach mathematics activities. The head teachers were also in agreement that the learning using technology had made learners in their schools to learn mathematics activities through visualization. Further the head teachers also agreed that the use of technology had made creativity to be very high. This was a proven through what they said as teachers having been using various technological tools in teaching mathematics activities. However, there were a few descending voices from the teachers who had a negative attitude towards the use of technology in teaching mathematics activities in EYE as supported by 39(27.3%) who disagreed that technology makes learners to learn mathematics through visualization and 31(21.6%) who disagreed that, teaching mathematics activities in EYE using technology engages the learners.

Teachers' attitudes and beliefs regarding the instructional value of technology play an important role in determining how fully they integrate technology into the classroom.

When pre-school teacher candidates' views towards ICT were studied, it was found that they also had favourable opinions about using ICT (Oğuz, Ellez et al., 2011). However, research indicates that the expected level of ICT use in pre-school education settings differs from the courses pre-school teacher candidates studied about ICT in university education (Kalogiannakis, 2010). ICT literacy is based on basic computer abilities, but preschool teachers need more than this to incorporate ICT into their lessons (Wetzel, 2004). The way that early childhood educators and teacher candidates receive training on new technologies must be identified and improved, as this is crucial to the use of technology by these educators. Fu, (2013) has highlighted resistance within the wider community as one of the causes of negative attitude. In the African setup technology is believed to be the source of every kind of misleading of children and thus it is very difficult to allow the learners to freely interact with technological gadgets such as phones. The socio-economic differences have also led to negative attitude especially to those that cannot afford the gadgets. Abel *et. al* (2022) assert that technology integration in teaching is still in its early phases due to inadequacy of qualified teachers in ICT as well as poor perception by teachers. They found out that teachers generally hold positive attitudes towards the use of technology in teaching, learning, and assessment, with high self-efficacy regarding ICT use. From this it is evident then that they have positive attitude towards the use of technology.

4.3.5 Adequacy of use of technology in teaching mathematics activities in EYE in Bungoma County

The third objective of the study sought to determine the adequacy of use of technology on teaching mathematics activities in EYE in Bungoma County. The study's responses were as shown in table 4.6.

Table 4.6 Adequacy of use of technology in teaching mathematics activities in EYE

Statements		SD	D	N	A	SA	Total	Mean	Std. Dev.
There are adequate interactive white boards in all classrooms	F	0	0	15	38	90	143	4.52	1.165
	%	0	0	10.8	26.6	62.6	100	90.4	
There are sufficient online gaming applications in the computers	F	0	0	15	38	90	143	4.51	0.275
	%	0	0	10.8	26.6	62.6	100	90.2	
The school has enough tablets used in teaching mathematics activities in EYE.	F	0	0	15	42	86	143	4.48	0.450
	%	0	0	10.8	29.5	59.7	100	89.6	
The school has enough desktop computers in EYE centres.	F	0	4	12	67	60	143	4.28	0.273
	%	0	2.9	8.6	46	42.4	100	85.6	
There are enough smart phones in school for teaching mathematics activities	F	0	4	12	67	60	143	4.28	0.236
	%	0	2.9	8.6	46	42.4	100	85.6	
There is reliable internet connectivity to support technology use in teaching mathematics activities in EYE	F	0	47	17	0	75	143	4.42	0.905
	%	0	32.9	11.9	0.0	55.2	100	88.4	
There is reliable electricity connection in school to support the use of technology in teaching mathematics activities in EYE	F	0	25	28	12	78	143	4.58	0.936
	%	0	10.8	26.6	8.6	54.0	100	91.6	

The responses on whether there were adequate whiteboards in the classrooms had 0 (0%) disagreed, 15 (10.8%) respondents were neutral, while 128 (89.2%) of the respondents agreed which translated to a mean score of 4.52 and standard deviation of 1.165. On the issue whether there are sufficient online gaming applications in the computers in EYE centres, 0(0%) of the respondents disagreed, 15 (10.8%) of the respondents were neutral and 128 (89.2%) of the respondents agreed. This had a mean score of 4.51 and a standard deviation of 0.275. The study also sought to find out whether there are enough tablets in school to use in teaching. The outcome was, 0(0%) of the respondents disagreed, 15(10.8%0 of the respondents were neutral, while 128(89.2%) of the respondents were in agreement. This translated to a mean of 4.48

and a standard deviation of 0.450. On the issue schools have enough desktop computers in EYE centres, the responses were, 4 (2.9%) of the respondents disagreed, 12 (8.6%) of the respondents were neutral while 127 (88.6%) of the respondents agreed. This transcribed to a mean of 4.28 and a std. deviation of 0.273. On the issue of whether there are enough smart phones in schools in teaching mathematics activities, 12(8.6%) of the respondents disagreed, 4(2.9%) of the respondents were neutral, while 127(88.4%) of the respondents agreed which translated to a mean 4.28 and a standard deviation of 0.236. On the issue there is reliable internet connectivity to support teaching mathematics activities in EYE centers, the responses were 47(32.9%) of the respondents disagreed, 17 (11.9%) of the respondents were neutral, while79 (55.2%) of the respondents agreed. This translated to a mean of 4.42 and the standard deviation of 0.905. Finally on the issue whether there is reliable electricity connection to support the use of technology in teaching mathematics activities schools, responses were 25(17.5%) of the respondent disagreed, 28(19.6%) of the respondents were neutral and 90(63.0%) of the respondents agreed that there was reliable electricity connection to support technology in teaching mathematics activities in EYE in Bungoma County. This translated to a mean of 4.58 and standard deviation of 0.936.

From the above analysis therefore, it is understandable there was adequate use of technology teaching mathematics activities in EYE in Bungoma County. This was evident by 128 (89.2%) of the respondents who were in agreement that there were adequate interactive whiteboards in schools, 128 (89.2%) of the respondents who agreed that there were sufficient online gaming applications in the computers and similarly 128(89.2%) of the respondents were in agreement that the school had enough tablets used in teaching mathematics activities in EYE. These statements were supported by the information gathered from the head teachers.

From the interviews carried out, the head teachers were in agreement since majority of them confirmed the availability of interactive whiteboards in their schools, sufficient online gaming in computers since they attested its use by the teachers of EYE and that they had purchased enough tablets in their schools which were in use during teaching and learning of mathematics activities I EYE. However, there was quite a number of respondents who had a contrary opinion on adequate use of technology in teaching mathematics activities in EYE in EYE in Bungoma County. This was supported by responses from 47(32.9%) of the respondents who disagreed that there was reliable internet connectivity to support technology use in teaching mathematics activities in EYE and 25(17.5%) disagreed that there was reliable electricity connection in school to support the use of technology in teaching mathematics activities in EYE. Further, from the observation made during the school visits, it was evident that there were a number of schools that had not been connected to electricity. This posed a question on the issue of internet connectivity since without electricity it would be difficult to operate internet.

From this observation there was a major concern especially to the schools that had no electricity yet were connected to internet. It was discovered that few schools had been connected to solar although they said it was expensive to install the solar panels. There were teachers who had smart phones and them, it as easy to use them for teaching since they only needed the data bundles and they could teach. There are teachers who do not have smart phones and hence the student phone ratio is wanting. They expressed the fear of the learners' age as a major challenge since they could not be allowed to be entrusted with phones to school by their parents for security purposes. It was from these concerns of information on the adequacy of technology that the researcher sought

to find out on the frequency of use of technology to ascertain its adequacy. This is shown in table 4.7 below.

Table 4.7: How often do you use the following tools in teaching mathematics activities in EYE

Tools	**Frequency**				
	Always	frequently	Occasionally	Rarely	Never
White Boards	10	30	70	23	10
Online Gaming Applications	20	30	70	13	10
Desk Top Computers	20	40	70	10	3
Tablets	50	80	10	3	0
Smart Phones	50	60	20	10	3

From the table above, it could be true to say the technological tools are mostly used in teaching mathematics activities in EYE. Phones and tablets are the most regularly used technological tools in teaching mathematics activities in EYE. It could also be true to say that most EYE teachers are competent thus can derive information from their mart phones and use it in teaching mathematics activities in EYE. It could be true to say that in this digital era, majority of the people own phones. It is surprising that there are quite a number of respondents who say that they have never used the technological tools mentioned. This has proved that there could be schools either with no internet or electricity hence the teachers cannot be connected to use technological tools in teaching mathematics activities in EYE. Those who rarely use technological tools are so many and this could be because it has not been made compulsory to use technology or other reasons.

Technology is seen to be very crucial and it might be used by teachers to deliberately arrange their math classes in order to interest and excite their pupils. A fresh and creative approach to leveraging digital tools and technologies for academic education

was game-based learning (GBL) (Fokides, 2018). Technology might motivate children to acquire the repetitive arithmetic skills they must practice in order to master them in an enjoyable way inside the classroom.

Learning outcomes are considerably improved by the expanded knowledge and management capabilities that technology offers to a system's numerous components (Kang & Im, 2013). It achieves this by empowering students with the skills to actively direct their own learning and to create evaluation procedures that assist them fill in knowledge gaps that prevent them from attaining better results (Dunn et al., 2013). Additionally, it gives students the resources to interact with their peers, connect with subject matter experts, and access a variety of information sources to deepen their comprehension of the ideas they wish to study. Additionally, because technology makes it easier to alter and add to the body of knowledge, it also enables students to contribute to making content simpler to absorb and comprehend by using the many toolkits available to develop more efficient delivery modalities like videos (Voogt and Roblin, 2010).

From the above discussions, it is true to state that technology is a very important tool in instruction in general. It is therefore very encouraging to learn that majority of the teachers in Bungoma County agree that their EYE centres have sufficient technology which they use in teaching of mathematics activities. Apart from the teachers in class, the research agrees with Lee &Scot (2022) who are in favour of technology since according to them, it draws youngsters to various voices and noises that lead to cognitive processes. Sufficient technology also increases interaction when children work in pairs at a computer, Cherney &Dempsey, (2010). With enough resources, learners become independent in learning and are more likely to grow into autonomous and successful technology users.

The theoretical framework (TPACK) used in this study elaborates the importance of the three domains that are very important in teaching and learning. One of the domains is the Technological Knowledge (TK) which is key. Technology according to this theory is very important in as far as teaching and learning is concerned. Technological Knowledge (TK) addresses how teachers demonstrate professional knowledge of technology. TK considers what is required for teachers to integrate technology tools and resources into their course content and instructional practice. The technology component of TPACK in Technology is most beneficial for learning when it brings a change in professional teaching practice and in designs for learning. For teachers, TK not only addresses knowledge about technology but also knowledge of the skills needed to use technology to effectively plan instruction, including with science teachers. TK involves understanding cross-platform applications and capabilities as well as how to configure those applications to realize instructional objectives and student learning outcomes and therefore how frequently one uses a particular technological tool

4.3.6 Teaching methods used in Teaching Mathematics Activities in EYE

The study sought to investigate the effects of teaching methods used on teaching mathematics activities in EYE in Bungoma County. The study findings were as shown in table 4.8.

Table 4.8: Teaching method used in Teaching mathematics activities in EYE

Statements		SD	D	U	A	SA	Total	Mean	Std Dev.
I use interactive white board in teaching mathematics activities in EYE	F	7	12	23	61	40	143	3.99	0.971
	%	5	8.6	15.8	42.4	28.1	100	79.8	
I do not use scaffolding in teaching mathematics activities in EYE	F	7	15	21	57	43	143	2.81	0.439
	%	5	10.8	14.4	39.6	30.2	100	56.2	
I use animation in teaching mathematics activities in EYE	F	0	3	20	89	31	143	2.97	0.546
	%	0	2.2	13.7	61.9	22.3	100	59.4	
I use gamification in teaching mathematics activities in EYE	F	7	11	25	40	60	143	2.80	0.167
	%	5	7.9	17.3	28.1	41.7	100	56.0	
I use videos in demonstrating complex concepts in teaching mathematics activities in EYE	F	0	3	21	62	57	143	2.88	0.123
	%	0	2.2	15.1	43.2	39.6	100	57.6	

The fourth and last objective of this study sought to find out the various teaching methods used in teaching mathematics activities. On the issue “I use interactive white board in teaching mathematics activities in EYE, 19(13.6%) of the respondents disagreed, 23(15.8%) of them were neutral and 101(70.8) of the respondents were in agreement which translated to a mean of 3.99 and a standard deviation of 0.971. On the second issue, “I do not use scaffolding in teaching mathematics activities in EYE,” 22(15.8%) of the respondents disagreed, 21(14.4%) of them were neutral while 100(69.2) of them agreed. Further, on the issue I use animation in teaching mathematics activities in EYE 3 (2.2%) of the respondents disagreed, 20(13.7%) of the respondents were neutral and 120(84.1%) of then disagreed amounting to a mean of 2.97 and a standard deviation of 0.546. On the issue I use gamification in teaching mathematics activities in EYE, 18(12.9%) of the respondents disagreed, 25(17.3%) of them were neutral and 100(69.8%) of the respondents agreeing. Finally, the issue on I use videos in demonstrating complex concepts in teaching mathematics activities in EYE elicited the following responses; 3(2.2%) of the respondents disagreed, 21(15.15) of the

respondents had a neutral stand while 119(81.8%) of the agreed transcribing to a mean of 2.88 and a standard deviation of 0.123.

From the analysis above, majority of the respondents agree to the fact that they used a variety of technological methods in teaching mathematics activities in EYE. This was substantiated by 120(84.1%) of the respondents who agreed that they used animation in teaching mathematics activities in EYE, 119(81.8) who agreed that they used videos in demonstrating complex concepts in teaching mathematics activities in EYE and 101(70.8%) of the respondents who agreed that they use interactive whiteboards to mathematics activities EYE. In solidarity with these findings, the head teachers said that teachers in their schools use interactive whiteboards in teaching mathematics activities in EYE, they use animation and gamification in teaching mathematics activities and that teachers in their schools use videos in demonstrating complex concepts in teaching mathematics activities in EYE.

However, when interviewed about scaffolding as a method used in teaching, majority of them disagreed and when further interrogated on the same, majority of them could not explain what the method entailed. This therefore was evidence enough that the response to the use of this method was negative most probably because teachers and head teachers did not understand what it was. From the observations made, it was clear that teachers of EYE in these schools used interactive whiteboards, in some lesson that were ongoing, the teachers were using videos in clarifying complicated concepts to learners of EYE. However, it is also important to note that there was a number who had a contrary opinion and should not be ignored. This is supported by 100(69.2%) of the respondents who agreed that they do not use scaffolding in teaching mathematics activities in EYE and 19(13.6%) of the respondents who disagreed that they use interactive whiteboards in teaching mathematics activities in EYE.

Pedagogy is one of the key elements in the theoretical framework (TPACK) whose proponents are Mishra & Koehler, (2006). They stated that the teacher who is competent and has the right attitude will use the method and thus it will be easy for the research to ascertain how frequently technology is used by teachers. On the other hand, the frequency of use of technology will proof the competency of the teacher and their attitudes. Regular or and frequent use will explain the positivity of the teachers and their knowledge about technological tools used.

Pedagogical Knowledge (PK) as stated in the theoretical framework, addresses how teachers demonstrate professional knowledge of pedagogy. PK refers to the specific knowledge about teaching such as approaches or methods of how teachers teach a particular topic or how to support a concept to the diverse interests and abilities of learners. For teachers and educators, an effective teaching method /approach that engages learners in higher-order activities using real-world examples facilitated through different learning styles is the cornerstone of teaching and learning in the current era. This therefore addresses the fourth objective about methods used by teachers in teaching mathematics activities in EYE using technology in Bungoma County. A teacher who understands his content well will choose the most appropriate method or approach to use in his or her lesson in EYE centres. In this case the teacher will have to pick on the methods that will resonate well with age of the learners and the teaching resources in this case the use tools of technology.

In the case of this study, where the researcher is trying to look at how technology can be integrated in the teaching of mathematics activities in EYE, one of the most appropriate approaches is the use of interactive whiteboard in teaching mathematics activities which had 79 % of those who were in agreement to use it. According to https://www/usa.edu/blog/simulation-in-education simulation methods in teaching

calls for a teacher to create realistic scenarios and controlled environments for interactive or hands-on practice. This allows learners to experience situations and apply knowledge.

Similarly, simulation-based education is the pedagogical approach of providing students with the opportunity to practice learned skills in real-life situations. Educational simulation is a teaching method that tests participants' knowledge and skill levels by placing them in scenarios where they must actively solve problems. This is with the case of the current CBC. Technology has been widely given preference where learners have the opportunity to interact with technology to make learning more practical. Learners have access to technological devices like phones, tablets desktop computers gaming apps and videos so ass to easily practice complex concepts in learning of mathematics activities. Simulation is also used to engage students to capture and maintain student attention, delivering “aha!” moments where students navigate through challenging and realistic scenarios. This helps teachers in assessing and grading their students and last but not least providing a perfect backdrop for an interactive conclusion of the activities being taught.

Https://www/skillsyouneed.com/rhubarb/technology-based-learning-approaches.htm has given examples of approaches that are technology-based which can be used by EYE learners in this 21st century. These approaches include, flipped classroom, Inquiry based learning, active learning, gamification, personalized learning, digital literacy, blended learning, game-based learning collaboration platforms, student created content, project-based learning and collaborative learning among others. All these methods are interactive and student-centered.

4.4 Correlational Analysis

Table 4.9: Relationship between study variables

Correlations						
		Adequacy of use of technology	Teachers' competence	Teachers' attitude towards technology	Teaching method used	Teaching mathematics activities in EYE
Adequacy of use of technology	Pearson Correlation	1				
	Sig. (2-tailed)					
Teachers' competence	Pearson Correlation	.580**	1			
	Sig. (2-tailed)	0.000				
Teachers' attitude towards technology	Pearson Correlation	0.407	0.104	1		
	Sig. (2-tailed)	0.642	0.306			
Teaching method used	Pearson Correlation	.697	.853	.533	1	
	Sig. (2-tailed)	0.200	0.190	0.302		
Teaching mathematics activities in EYE	Pearson Correlation	.679**	.618**	.413**	.579**	1
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	
	N	177	177	177	177	177

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

The study results indicated that there was a significant relationship between adequacy of use of technology and teachers' competence (r=0.580, p=0.000). Pearson correlation coefficient of 0.580 showed a moderate positive correlation between adequacy of use of technology and teachers' competence. There was a significant relationship between adequacy of use of technology and teaching mathematics activities in EYE (r=0.679, p=0.000). Pearson correlation coefficient of 0.679 showed a strong positive correlation between adequacy of use of technology and teaching mathematics activities in EYE.

There was a significant relationship between teachers' competence and teaching mathematics activities in EYE (r=0.618, p=0.000). Pearson correlation coefficient of 0.618 showed a strong positive correlation between teachers' competence and teaching

mathematics activities in EYE. There was a significant relationship between teachers' attitude towards technology and teaching mathematics activities in EYE (r=0.413, p=0.000). Pearson correlation coefficient of 0.413 showed a weak positive correlation between teachers' attitude towards technology and teaching mathematics activities in EYE and that there was a significant relationship between teaching method used and teaching mathematics activities in EYE (r=0.579, p=0.000). Pearson correlation coefficient of 0.618 showed a strong positive correlation between teaching method used and teaching mathematics activities in EYE.

The study sought to establish the relationship between the study variables. The study results on the relationship between integration of technology in curriculum and teaching mathematics activities in EYE were as presented in table 4.11.

The results were that the method of having kids manipulate physical items to teach them abstract concepts is another illustration of a technique that is developmentally appropriate (Dunn, 2001; Hsin, 2014). Thus, researchers have questioned the consequences of modifying real-world and digital resources on kids' acquisition of science and mathematical ideas (Zacharia, Loizou, & Papaevripidou, 2012). Additionally, encouraging social skill development is regarded as one of the crucial developmentally appropriate behaviors for young children. Some academics contend that the use of various technologies by young children may hinder their development of social skills since these abilities are acquired through in-person interaction, which technology use prevents (Armstrong & Casement, 2000). Contrarily, other experts claim that technology really fosters children's social development in a number of ways (Infante et al., 2010). Researchers claim that the strategies they promote are developmentally appropriate on both sides of the debate. The complex connections

between children's technology use and their learning, however, may be missed by researchers and teachers as a result of such binary discussions.

4.5 Inferential Statistics

The study performed ANOVA and regression analysis to estimate the relationships between the study variables. The study results were as tabulated in table 4.10 and table 4.11.

Table 4.10: ANOVA Model

Model Summary						
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	F	Sig.
1	.936[a]	0.877	0.868	0.0868	99.676	0.000[b]

The ANOVA model indicated the simple correlation was 0.936 which indicates a degree of correlation. The total variation in teaching mathematics activities in EYE was 87.7% explained by integration of technology in curriculum (R Square=0.877).

The study results further revealed that the ANOVA model predicted teaching mathematics activities in EYE significantly well ($p=0.000^b$). This indicated the statistical significance of the regression model that was run and that overall the regression model statistically significantly predicted the teaching mathematics activities in EYE (i.e., it was a good fit for the data).

Table 4.11: Relationship between Integration of technology in Teaching mathematics activities in EYE

Coefficients[a]					
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	0.369	0.224		1.648	0.105
Adequacy of use of technology	0.263	0.024	0.534	10.744	0.000
Teachers' competence	0.170	0.026	0.319	6.604	0.000
Teachers' attitude towards technology	0.231	0.024	0.476	9.876	0.000
Teaching method used	0.248	0.026	0.485	9.737	0.000
a. Dependent Variable: Teaching mathematics activities in EYE					

The regression equation generated for the study was as follows.

Y (Teaching mathematics activities in EYE) = 0.369 (Constant) + 0.534 (Adequacy of use of technology) + 0.319 (Teachers' competence) + 0.476 (Teachers' attitude towards technology) + 0.485 (Teaching method used) + 0.224 (Std Error).

From the regression equation, adequacy of use of technology were the most important variable to teaching mathematics activities in EYE contributing 53.4 percent to teaching mathematics activities in EYE followed by teaching method used with 48.5 per cent. Teachers' competence and teachers' attitude towards technology contributed 47.6 per cent and 31.9 per cent to teaching mathematics activities in EYE respectively. The regression equation further revealed that there was a significant relationship between adequacy of use of technology and teaching mathematics activities in EYE (p=0.000); there was a significant relationship between teachers' competence and teaching mathematics activities in EYE (p=0.000); there was a significant relationship between teachers' attitude towards technology and teaching mathematics activities in EYE (p=0.000) and that there was a significant relationship between teaching method used and teaching mathematics activities in EYE (p=0.000).

CHAPTER FIVE

SUMMARY OF THE FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

5.0 Introduction

This chapter presents summary of the findings, conclusions and recommendations as guided by the objectives of the study. These objectives were, to assess teachers' competency in the use of technology in teaching mathematics activities in EYE, to determine teachers' attitude towards the use of technology in teaching mathematics activities in Early Years Education, to establish how adequately technology is used in teaching mathematics activities in EYE and to establish teachers' teaching methods in teaching mathematics activities in EYE using technology.

5.1 Summary of the Findings

5.1.1 Teachers' Competency in the use of Technology in Teaching Mathematics Activities in EYE

The study established that majority of the teachers 117(82.0%) of EYE had skills in using technological tools, majority of them 117(81.3%) found it easy to use technological tools while 101 (70.5%) of teachers were knowledgeable in accessing and using content on interactive whiteboards. The interviewed head teachers agreed that teachers of EYE had basic knowledge, had been trained and had the expertise in the use of technological tools in teaching mathematics activities. However, a few of the teachers disagreed that they had the competency to teach mathematics activities using technology.

5.1.2 Teacher's Attitude towards Using Technology in Teaching Mathematics Activities in EYE

The study established that**,** majority of the teachers had a positive attitude towards the use of technology in teaching mathematics activities in EYE as supported by 138(96.4%). The interviewed head teachers agreed that lessons in EYE classes had been interactive due to technology integration, learners were able to learn through visualization making them more creative. However, there were a few descending voices from the teachers who had a negative attitude towards the use of technology in teaching mathematics activities.

5.1.3 Adequacy of Technology Used in Teaching Mathematics Activities in EYE

On how adequately technology is used in teaching mathematics activities, majority of the teachers stated that there was adequate use of technology in teaching mathematics activities as supported by 128 (89.2%) of the them who were in agreement that there were adequate interactive whiteboards in schools, sufficient online gaming applications in the computers and enough tablets used in teaching mathematics activities in EYE. The interviewed head teachers, were in concurrence that interactive whiteboards were used by teachers, there were sufficient online gaming in computers and that there were enough tablets which were in use in teaching. However through observation a number of teachers said that there was poor electrical and internet connectivity.

5.1.4 Methods Used in Teaching Mathematics Activities in EYE Using Technology

On methods used to teach mathematics activities in EYE using technology, teachers and head teachers were in agreement that they used animations, videos, interactive whiteboards and some used scaffolding. However through observation, a few teachers were not able to use scaffolding.

5.2 Conclusions

5.2.1 Teachers' Competency in Teaching Mathematics Activities in EYE using Technology

On teacher's competency in teaching mathematics activities in EYE using technology, the study concluded that majority of the teachers of EYE had skills in using technological tools in teaching mathematics activities. The interviewed head teachers supported this by saying that teachers of EYE in their schools had basic knowledge about the use of technological tools in teaching mathematics activities, they were trained in using the technological tools, had the expertise in the use of technological tools and had been integrating technological tools in teaching mathematics activities. However, a few of the teachers of EYE disagreed that they had the competency to teach mathematics activities using technology.

5.2.2 Teachers' Attitude towards using Technology in Teaching Mathematics Activities in EYE

On teacher's attitudes towards using technology in teaching mathematics activities, the study concluded that majority of the teachers had a positive attitude towards the use of technology. The head teachers agreed that lessons were interactive due to technology integration, learners were able to learn through visualization and were more creative. However, a few teachers had a negative attitude towards the use of technology in teaching mathematics activities.

5.2.3 Adequacy of use of Technology in Teaching Mathematics Activities in EYE

On how adequately technology is used in teaching mathematics activities, the study concluded that there was adequate use of technology in teaching mathematics activities. The head teachers were in agreement that teachers used interactive whiteboards, online gaming in computers and tablets in teaching mathematics activities.

However, through observation a number of teachers said that there was poor electrical and internet connectivity.

5.2.4 Teaching Methods of Mathematics Activities in EYE

On methods used to teach mathematics activities in EYE using technology, the study concluded that teachers used animations, videos, interactive whiteboards and some used scaffolding. However through observation, a few teachers were not able to use scaffolding.

5.4 Recommendations

The study made following recommendations: The school management in conjunction with parents should set aside funds for capacity building for teachers on technology integration in teaching as well as sensitization on attitude change towards use of technology in teaching. The school management and the county government should work hand in hand to install solar panels to enhance power connectivity which will enable teachers to integrate technology in teaching.

5.5 Suggestions for Further Study

A research can be carried out on the integration of technology in teaching other science subjects such as biology, chemistry and physics

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APPENDICES

Appendix I: Early Years Education Teachers' Questionnaire

I am a postgraduate student of Moi University carrying out a research on the teachers' integration of technology in teaching Mathematics in EYE in Bungoma County, Kenya, in partial fulfillment for the award of the degree of master's in Education Communication technology. The information given on this questionnaire shall be held in strict confidence and be used only for the purpose of study. You are requested to read each question carefully and provide your honest response. Please tick (√) on your appropriate response or write your answers in the spaces provided.

SECTION A: BIO DATA

1. Gender?

   Male ☐

   Female ☐

2. Age bracket?

   20 -30 years ☐

   31 – 40 years ☐

   41 – 50 years ☐

   Above 50 years ☐

3. Level of education?

   Certificate ☐

   Diploma ☐

   Bachelors' Degree ☐

   Masters ☐

4. Teaching Experience:

   Below 5 years and below ☐

Between 6 to 10 years ☐

11 and above years and above ☐

SECTION B: TEACHERS' COMPETENCY IN USING TECHNOLOGY IN TEACHING MATHEMATICS IN EYE

Please respond to the following statements expressing your views on teachers' competency in use of technology in teaching mathematics activities in EYE.

Provide your response to the issues on computer application skills relevant for effective use of technlogy in teaching mathematics activities as stated in the table below by ticking values 1-5 based on the key provided. 1 – SA – Strongly Agree, 2 – A – Agree, 3 – NS – Not Sure, 4 – D – Disagree, 5 SD – Strongly Disagree.

DESCRIPTION	1	2	3	4	5
I am knowledgeable in accessing and using content loaded on interactive whiteboards.					
I am adequately trained in using school tablets/ laptops for teaching mathematics activities.					
I have the expertise in the use of hand held gaming apps in teaching mathematics activities.					
I don't need expertise to use a tablet in teaching mathematics activities.					
I have enough skills in using educational apps in teaching mathematics activities.					

I find it difficult to use technology in teaching mathematics activities in EYE.					
I need a thorough training on cyber security, decorum and data privacy in the use of technology in teaching mathematics activities.					
I need to familiarize with mathematics educational software and tools.					

SECTION C: TEACHERS' ATTITUDES TOWARDS USING TECHNOLOGY IN TEACHING MATHEMATICS ACTIVITIES IN EYE

Please respond to the following statements expressing your attitude on the use technology in teaching mathematics activities in EYE.

Provide your response to the issues stated in the table below by ticking values 1-5 based on the key provided; 1 – SA – Strongly Agree, 2 – A – Agree, 3 – NS – Not Sure, 4 – D – Disagree, 5 SD – Strongly Disagree.

DESCRIPTION	1	2	3	4	5
The use of technology in teaching mathematics activities is interactive.					
The use of technology makes understanding of mathematics concepts easy.					
The use of personal computers has improved my efficiency in teaching mathematics activities.					

Technology makes learners to mathematics activities through visualization					
Creativity is very high when learners use technology in learning mathematics activities					
Use of technology enhances learner's communication in mathematics lessons					
Use of technology in teaching mathematics activities enhances problem-solving skills.					
Technology has features that give learners immediate feedback.					
In using technology, learners are more likely to be engaged.					

SECTION D: ADEQUACY IN USE OF TECHNOLOGY IN EYE

1. Please respond to the following statements expressing your views on teachers' adequacy in use of technology in teaching mathematics activities.

Provide response to the issues stated in the table below by ticking values based on the key provided:

1 – SA – Strongly Agree, 2 – A – Agree, 3 – NS – Not Sure, 4 – D – Disagree, 5 SD – Strongly Disagree

DESCRIPTION	1	2	3	4	5
There are adequate interactive white boards in all classrooms					
There are sufficient online gaming applications in the computers					
There are enough tablets in school to use in teaching.					
The school has enough computers in EYE centres.					
There are enough smart phones in schools for teaching mathematics activities.					
The school has enough tablets used in teaching mathematics activities in EYE.					
There is sufficient internet in my centre.					

SECTION E: TEACHING METHODS USED BY TEACHERS IN MATHEMATICS ACTIVITIES

Please respond to the following statements expressing your views on teachers' competency in use of technology in teaching mathematics activities in EYE.

Provide response to the issues stated in the table below by ticking the values 1-5based on the key provided. 1 – SA – Strongly Agree, 2 – A – Agree, 3 – NS – Not Sure, 4 – D – Disagree, 5 SD – Strongly Disagree.

DESCRIPTION	**1**	**2**	**3**	**4**	**5**
I use simulation in teaching mathematics activities.					
In the use of simulation, learners learn from observation.					
This method offers a real-life experience in most mathematics concepts.					
This method enhances a hands-on activity in lesson					
Teaching without technology enhance learners' better retention					
The method enhances the learners 'creativity.					
Learners who use this method improves their and problem-solving skill					
The traditional method often involves repetitive practice which contributes to learner's mastering of skills.					
The use of the conventional method enrich the learning of mathematics learning concepts					
The learners who use conventional understand the application of mathematics concepts in real life.					

Appendix II: Interview Schedule For Head Teachers

I am a postgraduate student of Moi University carrying out a research study teachers' integration of technology in teaching Mathematics in EYE in Bungoma County, Kenya, in partial fulfillment for the award of the degree of master's in Education Communication technology. The responses given in this interview shall be held in strict confidence and be used only for the purpose of study. You are requested to respond to each question openly and provide your honest response.

SECTION A: BIO DATA

1. What is your gender?

   Male ☐

   Female ☐

2. What is your age bracket?

   20 -30 years ☐

   31 – 40 years ☐

   41 – 50 years ☐

   Above 50 years ☐

3. What is your highest level of education?

   Certificate ☐

   Diploma ☐

   Bachelors' Degree ☐

   Masters ☐

4. For how long have you been a teacher?

   Below 5 years and below ☐

   Between 6 to 10 years ☐

   11 and above years and above ☐

SECTION B: TEACHERS' COMPETENCY

1. Have you had any training in any kind of technology used in teaching?
2. What are your experiences with using technology in teaching of mathematics activities?
3. Are your teachers competent in the use of technology in instruction?
4. How have you been evaluating the teachers' competency in the use of technology for teaching mathematics activities in EYE?

SECTION C: TEACHERS' ATTITUDE

1. Do you your teachers enjoy the use of technology in their classes?
2. Have your beliefs changed over time on the use of technology as a teaching tool in mathematics and if so, how?

SECTION D: ADEQUACY OF USE OF TECHNOLOGY

1. Do your teachers in EYE use technology in teaching mathematics activities?
2. Apart from teaching, what other activities in the school do you use technology for?
3. Which technology is mostly used in your centre teaching mathematics activities?
4. How often do your teachers use technology as an instructional tool in mathematics activities in EYE?
5. Based on your experiences in observing teachers' use of technology as an instructional supplement, have you noticed any significant changes in student motivation or achievement in mathematics activities? If so, why?

SECTION E: TEACHING METHODS

1. Are there any negative effects associated with the use of technology in teaching mathematics activities in EYE?

2. What factors influence the effectiveness of using technology in teaching mathematics activities?
3. Do you think technology has played a major role in performance in mathematics in your institution and if yes how?

Appendix III: Moi University Introductory letter

MOI UNIVERSITY
Office of the Dean, School of Education

Phone No. +254 790 940 508
+254 736 138 770
Email: deaneducation@mu.ac.ke

P.O. Box 3900
Eldoret
Kenya.

REF: MPECT/5990/22 **DATE**: 16th May, 2024

THE EXECUTIVE SECRETARY
National Council for Science and Technology
Box 30623-00100
NAIROBI

Dear Sir/Madam,

RE: RESEARCH PERMIT IN RESPECT OF WANGILA VIOLET MUYOKA - MPECT/5990/22

The above named is a 2nd year PhD Student at Moi University, School of Education, Department of Curriculum, Instructional & Educational Media.

It is required of her PhD studies to conduct a research project and produce a research report. Her research topic is entitled:

"Teachers' Integration of Technology in Teaching of Mathematics in EYE in Bungoma County, Kenya."

Any assistance given to enable her conduct research successfully will be highly appreciated.

Yours faithfully,

MOI UNIVERSITY
SCHOOL OF EDUCATION
DEAN
16 MAY 202
Sign
Box 3900-30100, ELDORET

PROF. ANNE S. KISILU
DEAN, SCHOOL OF EDUCATION

Appendix IV: NACOSTI Research Permit

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR
SCIENCE,TECHNOLOGY & INNOVATION

Ref No: **322077**

Date of Issue: **11/February/2025**

RESEARCH LICENSE

This is to certify that Ms...VIOLET MUYOKA WANGILA of Moi University, has been licensed to conduct research as per the provision of Science, Technology and Innovation Act, 2013 (Rev.2014) in Kenya on the topic: Integration of Technology in Mathematics Curriculum and its' Implication to classroom Instruction in Early Years Education in Kenya, for the period ending: 11/February/2016,

License No: **NACOSTI/P/25/415812**

322077

Applicant Identification Number

Director General
NATIONAL COMMISSION FOR
SCIENCE,TECHNOLOGY &
INNOVATION

Verification QR Code

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See overleaf for conditions

Appendix V: Plagiarism Awareness Certificate

SR915

ISO 9001:2019 Certified Institution

THESIS WRITING COURSE

PLAGIARISM AWARENESS CERTIFICATE

This certificate is awarded to

VIOLET MUYOKA WANGILA

MPECT/5990/22

In recognition for passing the University's plagiarism

Awareness test for Thesis **entitled TEACHERS' INTEGRATION OF TECHNOLOGY IN TEACHING OF MATHEMATICS IN EYE IN BUNGOMA COUNTY, KENYA with** similarity index of 21% and striving to maintain academic integrity.

Word count:27701

Awarded by

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