INFLUENCE OF MYIMATHS APPLICATION ON LEARNERS' PROFICIENCY ON ARITHMETIC CONCEPTS IN PRESCHOOLS IMPLEMENTING THE BRITISH NATIONAL CURRICULUM IN DAGORETTI NORTH SUB – COUNTY NAIROBI KENYA

BY

GATHARA IRENE WAMBUI

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DECLARATIONS

This project report is my original work and has not been submitted for a degree in any other university.

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Gathara Wambui Irene Date

Reg No. E57/71981/ 2011

This research project report has been presented with my approval as the university supervisor.

_____ _____

Prof. Paul Odundo Prof. Agnes Kibui

Department of Education Department of Education

Communication & Technology Communication & Technology

University of Nairobi University of Nairobi

_____ _____

Date Date

DEDICATION

This work is dedicated to all Preschool children, caregivers, parents and teachers.

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ABSTRACT

Teaching mathematics to preschoolers is therefore a matter of great importance as it forms the foundation of educational concepts in all areas of learning. Several scholars have laid different methods of teaching mathematics and the study will focus on a new concept of teaching the subject. The study purposes to investigate the influence of Myimaths application on preschoolers' proficiency on arithmetic concepts in preschools implementing the British National Curriculum in Dagoretti North Sub – County in Nairobi. The study was guided by four research objectives aimed to establish the influence of a manipulative number grid and number line and to investigate the influence of teacher and parental involvement in preschooler's proficiency on arithmetic operations. The adoption of online applications for teaching preschoolers basic mathematical concepts has been growing steadily, mainly because these applications integrate a variety of teaching learning activities thereby making the processes less strenuous and with great results. Online applications such as Myimaths have been recognized to enhance learner development in arithmetic skills at ECD level, little has been documented about the same in Kenya and thus necessitated the study. The Literature reviewed was discussed in light of the variables influenced by Myimaths application with regard to achievements in arithmetic concepts. The study was based on constructivist theory which emphasizes on construction and comprehension of epistemology. The study applied mixed method research design, which included descriptive survey design methods as data was generated using structured questionnaires, pre-tests and post-tests. The study targeted 2 preschools that implement the BNC curriculum, hence the study applied purposive sampling technique. Questionnaires and achievement tests were the tools that solicited information from 30 individual preschoolers, 7 preschool teachers and 11 parents. Data analysis and processing involved quantitative and qualitative data analysis techniques where editing, coding and thematic categorization of data was. The data was presented in form of tables, pie charts and figures. Results of the study indicated that Myimaths application was particularly influential in enhancing preschoolers' arithmetic skills and execution of operations. The number line and number grid influenced the concepts of subtraction and multiplication more than addition and division. The study indicated in a pre-test using a number line, the average score in RNS preschoolers was 92 percent while SAA had an average score of 82 percent. In the post-test RNS scored 96 percent while SAA scored 93 percent in arithmetic operations. The findings reveal that use of online math application boosts arithmetic proficiency in preschoolers. Hence, the findings lead to the conclusion that all preschoolers in both BNC and 2-3-3-3 curriculum be introduced to online platforms that introduce, teach and reinforce the arithmetic operations and skills. The study recommends that policy makers, Ministry of Education, Curriculum developers, KICD and all concerned priorities developing or adopting an online application that would be implemented national wide with the new Competence Based Curriculum.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACRONYMS

App -- Application

AQA – Assessment and Qualification Alliance

BNC -- British National Curriculum Pre School is a school offering the United Kingdom syllabus for preschool children.

CIE -- Cambridge International Examinations

Edexcel – Education Excellence

ECD -- Early Childhood Education

IB -- International Baccalaureate

KICD – Kenya Institute of Curriculum Development

NCTM -- National Council of Teachers of Mathematics

CHAPTER ONE: INTRODUCTION

1.0 Background to the study.

Mathematics is the science that deals with the logic of shape, quantity and arrangement of numbers, symbols, signs and patterns as building blocks in our daily lives. Mathematical concepts are used in our day to day activities and are therefore vital in building software used in building mobile applications used in architecture, art, accounting, engineering, and even sports , (Elaine, 2013). Teaching mathematics to preschoolers is therefore a matter of great importance as it forms the foundation of educational concepts in all areas of learning. Several scholars have laid different methods of teaching mathematics and the study will focus on a new concept of teaching the subject. Using online application enhances acquisition of arithmetic concepts (Mothibi, 2015). According to Lipton (2005) online learning applications including Myimaths resources are useful when teachers include them to deliver mathematics curriculum to preschoolers. Application of concrete objects like manipulative blocks, legos, counters, worksheets, white boards and interactive white boards, clickers, graphing calculators, practice drills, videos, online games, mathematics activities and digital tools facilitate interaction which promotes learning. Further, arithmetic teaching resources are significant in acquisition of computation skills, (Fayiz Aldhafeeri, Ioanna Palaiologou and Aderonke Folorunsho, 2016). The most current and effective teaching resources are digital platforms.

Teresa (2018) states that Myimaths is a fully interactive application with ready-made lessons with homework activities linked to every lesson. Myimaths offers unlimited practice with varying activities that covers mathematics content from basic mathematics to complex mathematics. The application is a convenient tool for teachers as it saves time with arithmetic progress assessments,

tracking records and marking for individual preschooler. Myimaths is tailored for International Baccalaureate (IB), Cambridge International Examinations, Edexcel and Oxford International Assessment and Qualification Alliance (AQA) Examinations. Myimaths has a platform for educators to share their experiences and challenges on using Myimaths application. The concept of teaching using online applications including Myimaths implies that if effectively used in delivering the arithmetic concepts to preschoolers, there will be enhanced performance in mathematics among learners. This study seeks to establish the influence of Myimaths application in acquisition of arithmetic concepts in preschools implementing the British National Curriculum in Dagoretti North Sub County Nairobi, Kenya.

Online applications have been embraced worldwide as an online resource for teaching and learning mathematics. Myimaths has more international curricular support than any other online mathematics resources that strengthens students' results. United States has adopted online colleges and schools have thousands of online courses available to students, pupils and preschoolers. India provides online learning opportunities throughout Asia with successful students experiencing the use of online programs in their world class preschools, schools, colleges and universities. Gutierrez (2017) adds that China offers online education programs to all learners from preschool to university students. Ihub (2014) reported that The Kenya Institute of Curriculum development (KICD) implemented in 2013 the digitized programs for learning and created an interactive platform in the curriculum for students' participation in online programs. Today, preschoolers in Kenya have the opportunity of using online programs like the

'Tusome' online application which has been designed to improve primary literacy outcomes. MoEST (2016) opines that Tusome enhances teachers' capacity to effectively deliver classroom

instructions, improves schools' access to appropriate books and other learning materials, enhances instructional support and supervision which enhances collaboration with other literacy actors.

According to a research conducted by McPake (2016), the use of tablet applications in teaching Gaelic language proved effective. Halilou (2016) states that 'OkpaBac' online platform prepares high school students for IB for students aged 3 to 19 to improve their academic performance. Heick (2018) expounds on the latest android applications Myimath, educationcity, Khanacademy, Arcademic skill builders, Mathdoku among others that are useful as teaching aids for imparting arithmetic skills effectively to preschoolers. McPake (2016) and Zarani (2013) compared learning outcomes while using digital platforms and confirmed that they are the most effective tools for teaching arithmetic. McPake said the following "because of the skill based nature of mathematics in general, mathematics resources pair especially well with digital tool likes Apps and web sites. On these kinds of platforms, accounts are created and progress is visualized, mastery is documented, complexity can be adjusted to individual needs and achievements can even be given as kind of motivation mechanic." The statement affirmed that digital platforms were very effective in teaching mathematics.

Myimaths application allows parents, teachers and caregivers to access online resources that can be used to teach preschoolers arithmetic concepts at any time of the day. It provides guidelines to teachers, parents and caregivers on how to give assistance to the preschooler. It automatically generates the scores of the preschoolers' online performance tests and gives real time feedback efficiently and effectively. According to Nicholas (2013), learning through play is effective in achieving arithmetic objectives for children at the preschool and primary school levels. According to National Council of Teachers of Mathematics (2000), learning arithmetic while using technology is an integral part of nurturing mathematics from an early age in the kindergarten.

Preschooler learns mathematical concepts that include concepts of numbers and number operations as early as before preschool.

According to the Department for Education of the UK (2017), preschoolers learn proficiency of numbers and numerical operation in form of arithmetic concepts and operations such as addition, subtraction, multiplication and division in arithmetic. Arithmetic operations involve counting, comparing numbers, combining, grouping, partitioning and composing of numbers (Julie, 2009). A preschool teacher may use the online application or the traditional approach to teach arithmetic concepts. Myimaths educational online application enhances preschoolers understanding of addition operations better than the teacher centered approach. It facilitates preschoolers to successfully learn and practice addition skills of counting on till twenty, adding one more using a number line, mastering number bonds of 5 and adding single digit numbers. Myimaths application as lesson or online homework reinforces the learnt content or use it for revision, performing better in addition than preschoolers who rely only on the content from the teacher.

Myimaths application has inbuilt fully interactive number lines, for learners to use in counting on activities. The preschooler reads the instructions on the activity and follows step by step. Myimath allows preschoolers to use the interactive number lines by clicking and dragging the curser from the first number to the second number, to get the total of the sum. Myimaths addition activities prepare preschoolers to improve on accuracy in estimation of bigger integers (Bos, 2015). According to Cambridge (2018), high performance in the international exams from schools using Myimaths application was noted. Donagan (2018) observed that using a number line engages learners to actively draw a straight line using a ruler on a paper. The line becomes the base number line, the preschooler writes hash marks on the line and below the marks the preschooler writes numbers from zero to 10 from left to write. In solving addition sums, the preschooler must

determine the first number and the second number. The preschooler starts counting from the first number and makes jumps of the second number tagged as complementary addition. Children are likely to make errors when drawing the harsh marks and when writing the numbers sequentially on the number line, Diezmann, (2018).

According to Valli (2017), online learning applications are more effective than traditional instructional approaches in giving instant feedback on instructions at the point of learning. He further points out that online applications such as Myimaths application has subtraction instructions; place value, counting back, taking away single digits, these skills are relayed at the point of learning, powered by in-app technology, a preschooler receives accurate feedback and corrective measures instantly on subtraction. Fahiminezhad (2018) said that traditional pedagogy focuses on drilling and lecturing preschoolers, hence many faults and errors. The preschooler uses the back jump strategy to subtract using a number line. The preschooler puts the big number on the right hand side of the number line then makes jumps of the number to take away in ones or tens from the right to the left as they write the answers in steps. According to Linchevski et al (1999), subtraction skills prepare preschooler to learn the concept of negative numbers. The processes of addition and subtraction become interchangeable in the case of integers (Bruno, McQuarrie, & Torgrimson, 1999).

Myimaths application includes arithmetic games that stimulate learning. One such game is called "Beat the clock" game. The game allows preschoolers to compute sums while mastering fluency and accuracy in solving multiplication and division sums. Myimaths Snakey game sums are designed to engage preschoolers' progress whilst working out time tables. The purpose of Myimaths Snakey game is to enhance usefulness of numerical ideas to preschoolers when they encounter and use various representations of the same concept. Preschoolers begin to understand

multiplication when they realize the conceptual meaning of the lots of, groups of and the number of objects in each group (Safi, 2009). However, the teacher centered approach focuses on rote counting and cramming of times tables. Wolfram (2010) criticizes the use of traditional mathematics instructions citing that they are less effective compared to alternative pedagogy. According to Wolfram (2010) traditional pedagogy of instructions emphasizes memorization and repetition, and fails to present mathematics as imaginative and experimental.

Myimaths application has an interactive number grid that preschooler use to add and multiply sums on any device. The task set for preschoolers is to complete the mental multiplication sums within a time limit focusing on assertiveness, accuracy, fluency and speed. Myimaths application add and multiply page, automatically generates values for the preschooler. The activity instills in preschoolers the concept of relating multiplication with addition as repeated addition. In using the Myimaths application preschoolers get a better mastery of multiplication relevant for higher achievement of mathematics. In the traditional approach, preschoolers with the help of the teacher draw items to match the repeated addition (Sumnicht, 2017). The teacher drills the concept for learners to cram and replicate the information, however, preschoolers often make errors while writing numbers as repeated addition (Diezmann, 2018).

Barnett- Clarke (2010) says that while unpacking the mathematical thinking, preschoolers learn to reason quantitatively about division and acquire a sense of size, amount and number fractions. Preschoolers learn that division is fair sharing of items and numbers as an interpretation of fractions. Sharing and grouping of amounts and numbers practically helps children with visualizing the content. In the teacher centered approach the preschoolers' use pencil and paper to solve division and fractions. Myimaths application has interactive activities of sharing amounts and shapes including a fraction golf game that instills division skills and confidence. The game

actively engages preschoolers by instructing the pupil to choose a club that has a maximum distance and strength. The preschooler selects how far to hit the ball by selecting a fraction and solving the sum. The preschooler gets a chance to swing the club only when the answer to the fraction is correct. The games keep the learner motivated by the reward to swing a club.

1.1 Statement of the Problem

Globally, online educational programs for preschoolers have been widely adopted. Online enabled devices have equally been availed to preschoolers, especially those pursuing British curriculum system, not only at school but also at home. Many international schools around the world including Kenya are using e-learning platforms. However, there has not been any online mathematical application launched to aid teachers in curriculum delivery on acquisition of arithmetic concepts in government schools. Teachers still use the teacher centered approach and spend much time drilling mathematical concepts through lecturing and rote memorization of arithmetic concepts. Moreover, the teacher spends much time in writing both class work and homework in the children's exercise books while there are readily available and free online applications that does the same work including setting exams thus save time. Although the online mathematics applications are available, no studies on their influence in acquisition of arithmetic skills for the preschoolers have been carried out in Kenya. It is in this view that the study sought to examine the influence of Myimaths application on acquisition of arithmetic concepts in preschools implementing the British National Curriculum in Dagoretti North Sub-County in Nairobi Kenya.

1.2Purpose of the study

The study set to examine the influence Myimaths application activities and lessons on preschooler's performance in the acquisition of arithmetic concepts. Myimaths is a comprehensive mathematical app for learners. The study investigated if children who use the Myimaths application performed better on numeracy assessments than students who engaged in teacher led hands-on mathematics instructions.

1.3 Objectives of the study

The study strives to achieve the following objectives:

1. To assess the influence of a manipulative number line on proficiency of arithmetic concepts.
2. Establish the influence of a manipulative number grid on proficiency of arithmetic concepts.
3. To evaluate the influence of teacher involvement and proficiency of arithmetic concepts.
4. To establish the influence of parental involvement and proficiency of arithmetic concepts

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1.4 Research questions

1. How does a manipulative number line influence proficiency of arithmetic concepts to a preschooler?
2. Does a manipulative number grid influence proficiency of arithmetic concepts to a preschooler?
3. How does the teacher involvement influence proficiency of arithmetic concepts to preschoolers?
4. To what extent does parental involvement in homework influence proficiency of arithmetic concepts?

1.5 Significance of the study

The findings and recommendation of the study's input will be of great value to various education stakeholders. To begin with, the study's input will inform educators, curriculum developers and all caregivers about the use of online applications such as Myimaths, for teaching and learning mathematical concepts. The study's input will also contribute to the advancement in knowledge in ECD development in Kenya and may be of immediate benefit to the government, private institutions developing educational applications and the community. The study's input will provide new and creative ways of motivating and engaging preschoolers of all abilities, enabling and inspiring preschoolers to attain their educational potential. The study could finally form a base on which other researchers can develop their studies.

1.6 Limitations

According to Orodho (2016) limitation is an aspect of the study that the researcher knows may adversely affect the results or generalizability of the results of the study, but over which he/she has no direct control. The study encountered a number of limitations. First there was dearth literature on Myimaths application in Kenya especially in preschools and the study relied heavily on literature outside Kenya. The study was limited to pre-schools offering BNC and not the national curriculum because of lack of technology in classrooms and at home. It was difficult to completely control other sources of learning that could lead to addition, subtraction, multiplication and division.

1.7 Delimitations

The delimitation of the study is the boundary limitation (Orodho, 2012). The study was delimited to preschoolers aged five to six years' old enrolled in schools teaching the British National Curriculum (BNC) Preschools in Dagoretti North Sub-county. This is because the curriculum involves active use of information technology in content delivery of several subjects including mathematics. The BNC Preschools are up to date with IT infrastructure. They have computers and a well laid network, internet and intranet to facilitate curriculum delivery.

1.8 Basic Assumption

The study assumed that the learners exceeded expectations in identifying numbers, arithmetic signs and symbols and place value. It assumed that the preschoolers were conversant with basic operations of a computer and could easily navigate the search engine independently. It assumed that the devices used by the children would not influence the children to play online games that were not intended to be part of the online programs. The study assumed parents were computer

literate and assisted preschoolers with homework. The parents owned computers that had been connected to the internet. The study equally assumed that teachers were computer literate and taught arithmetic concepts using Myimath application during numeracy lessons. The study assumed that the preschoolers could read and follow instructions on Myimaths application.

1.9 Definition of terms.

1. **Arcademic :** Arcade and Academics are online games for young children which are built in with the latest technology.
2. **Arithmetic Concept:** knowledge taught in mathematics for children between 5 – 6 years old.
3. **Education city:** an educational resource for children between 3 and 12 years and their teachers.
4. **I.T:** Use of computers in learning.
5. **Khan Academy:** is a non-profit educational organization that provides free video tutorials and interactive exercises.

   Learning outcomes: this are the functions learners are able to achieve after a specific task
6. **Math doku:** printable puzzle that combines arithmetic and math's skills with logical reasoning.

   Manipulative number line: is

   Manipulative number grid
7. **Myimaths:** an interactive online teaching and homework subscription that builds pupils engagement and consolidates math's Knowledge
8. **Preschool:** a school for young children between 2-6 year olds.
9. **Resources:** materials used for teaching mathematics to 2-6 year olds

10. **Skill builders:** collaboration of groups teachers, parents and partners with practical frameworks that help in capacity building for high performing groups to develop and share meaning and gracefully reach decisions
11. **Teacher involvement:** the participation of teachers in learners related activities
12. **Parental involvement**: this is the participation of parents in learners activities
13. **Manipulative Number line**: A manipulative number line is an online aid that helps preschoolers with solving arithmetic operations by dragging the caser in sequential steps on a line 0 - 100.
14. **Manipulative Number grid**: a manipulative number grid is an online aid that assists preschoolers with solving arithmetic operations by counting on, counting back and eventually children are able acquire procedural fluency.

CHAPTER TWO: REVIEW OF RELATED LITERATURE

2.0 Introduction

This chapter reviews literature related to the use of online application Myimaths in helping preschoolers on arithmetic proficiency. It focuses on acquisition of arithmetic proficiency in Early Childhood Education, and acquisition of arithmetic proficiency, Addition using Number line and acquisition of arithmetic proficiency, Manipulative number grid, Subtraction and acquisition of arithmetic proficiency, Subtraction Number line and acquisition of arithmetic proficiency, Multiplication and acquisition of arithmetic proficiency, Repeated addition and acquisition of arithmetic proficiency, Division and acquisition of arithmetic proficiency among others.

2.1 Acquisition of arithmetic proficiency in Early Childhood Education

According to the National Academies press (2018) preschoolers have an inborn ability to count items, identify shapes and develop number concepts. As preschoolers count items they must make utterances and certain procedures to make the number correspond with the items being counted. Preschooler's procedural fluency makes it possible for them to use mathematics reliably to solve problems. According to Packenham (2016) online applications have improved preschoolers' arithmetic concept acquisition and performance greatly. Myimaths application offers preschoolers unique opportunities to actively participate during arithmetic lessons and online homework. Myimaths application was prepared and developed for teaching, practicing and assessing children's math's fluency in addition, subtraction, multiplication and division.

Myimaths develops children's arithmetic skills, confidence and fluency through lessons, homework tasks and games. According to Drigas (2014) online application engages preschoolers in a competitive mental mathematics challenge that improves speed and accuracy. Myimaths interactive lessons match with corresponding online homework, which helps teachers teach and assign online homework and assess individual lesson. Myimaths allows progression and links the content being covered in arithmetic between school and home. The automatic self-marking helps the teacher to track and prepare lessons to reinforce arithmetic skills (Debela, 2015)

2.1.1 Addition and acquisition of arithmetic proficiency

Maier and Rasmussen (2018) suggests that the manipulatives and mathematical models typically used for teaching arithmetic relationships and operations may not be as helpful as once thought. They give the example of Base-10 blocks that were found to provide excellent conceptual understanding, were found to be weak in procedural representation of number operations. Myimaths addition concepts for preschoolers combine numbers to find the total of values. NTCM (2006) emphasized that online programs should emphasize on developing conceptual and procedural understanding of addition skills. Myimaths provides preschoolers with rich and unique opportunities to engage with numbers and the addition symbol to solve addition sums with whole numbers. Myimaths application 2018 has addition lessons and online homework activities that vary in the same operation and allow the teacher to access the preschooler's performance results, informing the teacher on individual ability. Preschool teachers using the teacher led approach use traditional approach that requires the teacher to spend time chanting and rote counting of addition sums to help children memorize addition sums (Lorrain, 2010).

2.1.2 Addition Number line and acquisition of arithmetic proficiency

Maier and Rasmussen (2018) study found that a number line is an easy tool for preschoolers to understand and is useful in assisting students understand the relative magnitude, position of numbers and visualize operations in addition. According to Dooley (2014) explains that digital tools assist in the development of preschooler's mathematical proficiency, adaptive reasoning, strategic competence, and productive disposition. According to Skoumpourdi (2010) states that number lines are didactic in teaching addition concepts. He continues to say that number lines support preschoolers with organizing their thinking when solving the addition sums. Number lines help to represent methods, thinking progressions, and solution strategies as well. Myimaths application is tailored with an online interactive number line, that expands when the preschoolers is adding values is stimulating and fun. Preschooler have a choice between working out sums mentally and using the number line in Myimath application. The manipulative ability of the Myimaths number line allows preschoolers to visualize and develop flexible mental strategies for addition sums. According to Fryholm (2010) use of a number line improves performance in preschoolers on addition skills**.** He adds that a number line allows preschoolers to develop mental addition skills as they actively construct mathematical meaning, number sense, and understandings of number relationships. Traditional teacher led approach does not have resources for preschoolers to use when learning addition concepts. According to Farooq (2014), the teacher led approach preschoolers duplicates the content mastered by the teacher.

2.1.3 Manipulative addition number grid and acquisition of arithmetic proficiency

According to Cradler (2018), preschool teachers should incorporate assistive technology in delivering the arithmetic concepts to preschoolers. However, Christine (2008) explored the use of ICT and proposed that it could be unproductive in teaching and learning for preschoolers. Myimaths application is tailored with addition and multiply tool grid that allows preschoolers to generate their own addition sums. The preschoolers answers as many addition sums. According to Cambridge Assessment international education results, more than 80% of the students who sat for Cambridge international exams in June 2018 passed their exams with grades ranging from A* to C. According to a study done by Qaznavi (2010) on impact of ICT in Iran, a noted success was recorded by high school students, hence upholding use of ICT in teaching preschoolers while the teacher led approach not highly supported focuses on the preschooler is a passive learner.

2.2 Subtraction and acquisition of arithmetic proficiency

According to Pearson (2018) preschoolers with challenges in solving arithmetic sums should be supported with enVisionMATHS Digital learning tools and games. Myimaths application includes resources that cater for preschoolers at the age of 5. According to Elena Dalrymple editorial director at theschoolrun.com in London, United Kingdom (2018) singing songs such as 'Ten Green Bottles' helps preschoolers to understand that when an object in a song goes there are other less objects left behind. Elena (2018) continues to state that when preschoolers count backwards every now and again, they gain confidence and are aware of how to work out subtraction sums. According to Cradler (2018) the use of technology is a great motivator to the preschoolers while carrying out subtraction sums.

Myimaths application has built-in lessons and online homework subtraction activities that allow preschoolers to carry out subtraction activities and games.

2.2.1 Subtraction Number line and acquisition of arithmetic proficiency

According to Maier and Rasmussen (2018), number line engages preschoolers in a systematic continual of numbers and helps in the representation of the number system that is ongoing, natural, and intuitive to preschoolers. Number line clarity and intuitive properties blend with existing cognitive structures, the number line is well suited to model subtraction problems, for example, that otherwise would require regrouping strategies common to block and algorithmic procedures. Virtual manipulatives are 'an interactive, visual representation of a dynamic object that presents opportunities for constructing mathematical knowledge' (Moyer et al., 2002). He also emphasizes on the mastery of subtraction strategies at the preschool level to promote success in arithmetic concepts. Myimaths number lines are extremely useful in learning subtraction concepts to preschoolers. According to NCTM (2016), preschoolers learn how to use number lines to subtract sums accurately and help them learn more deeply about the operation involved. The preschoolers use the number line to draw jumps of either ones or tens counting back. Shekari (2010) observed that the use of ICT in teaching and learning expand preschoolers' knowledge, experience and increase understanding especially when a number line in subtraction is used.

2.2.2 Subtraction counting back and acquisition of arithmetic proficiency

According to Education.com, (2018) preschoolers visualize the number and the operation when using a number line in subtraction boosting their ability to develop precision and accuracy when solving subtraction sums. Theresa (2018) mentions that Myimaths application has lessons for preschoolers on subtracting using a number line. The interactive number line in the application with various colours shows a preschooler the values on a number line and actively shows the preschooler. The application allows the preschooler to manipulate the active number line and show the steps to take away in steps of ones. The Myimath application counting on and back has a game that aims at the preschooler subtracting as many sums within 2 minutes. The game focuses boosting fluency, speed and accuracy. Zameni et.al (2011) points out that the use of online resources are effective in the acquisition of concepts.

2.3 Multiplication and acquisition of arithmetic proficiency

A study by Sylvia (2001) suggests that young children master multiplication through retrieval strategy. Similarly Raudy (2018) explains that leap from learning addition and subtraction to multiplication is a daunting task for most preschoolers. He continues to say that some teacher find multiplication a challenging subject to understand and teach. Therefore, he discourages the teachers from rushing through the content because the preschoolers feel intimidated and form a negative attitude towards the concept. Raudy (2018) reasons that when multiplication is taught as lots of, groups of and as repeated addition preschoolers visualize the concept. This kind of approach assists preschoolers to relate addition to multiplication which makes it easy to learn mathematics.

2.3.1 Repeated addition and acquisition of arithmetic proficiency

According to Prodigy (2018) Preschoolers learn multiplication better when the concept is introduced as repeated addition. Ahmadi, Fallah, & Mirzakhani (2011) observed that primary school children's performance outcomes were outstanding while using the online application. Myimaths application the preschoolers are introduced to the 2 times table as lots of or groups of items and pictures translating to repeated addition. The application demonstrates lots of 2 count in 2s by asking the preschooler to counts the number of plates. Each plate has 2 oranges, therefore, for the preschooler to get the correct answer he counts the number of oranges altogether. In the same activity, Myimaths allows the preschooler to answer the 2 times table direct sums. Myimaths challenged the preschooler with activities and games to improve on speed and accuracy using the beat the clock activity that has a timer. The preschooler later translates the concept by drawing arrays to help with multiplication calculations and as repeated addition using a number line. Prodigy (2018) states that preschoolers struggle with memorization of multiplication facts.

2.3.2 Myimath doubling multiple times and acquisition of arithmetic proficiency

Teresa (2018) doubling multiple times online lesson teaches the preschooler to break down a number being multiplied into bits by so that the preschooler can relate doubling and multiplication. For example 2 multiplied by 4. The instructions on the application instruct the preschooler to break number in to 2, so that the preschooler can multiply 2 by 2 then by 2. Zameni & Kardan (2011) acknowledges that use of multimedia boosted performance in a sociology class. Therefore, Myimaths aids the preschooler to break down the number understand the numbers in smaller unit and improve in mental calculations. In the traditional instructional approach the teacher being the source of all knowledge, lectures the preschoolers because she has very little time and a lot to cover within a period of time. Part of the lesson is taken home for practice (Neocoach, 2012).

2.4 Division and acquisition of arithmetic proficiency

According to Susan (2019) noted that division concept is understood better when introduced as a sharing operation of objects into a number of groups of equal number and as an opposite operation of multiplication. Division is about separating sets, while the opposite is called multiplication is about combining sets. This relationship is important for preschoolers when recalling basic facts to solve division problems as fact families (e.g. 5 x 3 =15, 3 x 5 = 15, 15 ÷ 3 = 5, 15 ÷ 5 = 3).Myimaths application teaches the preschooler to group the items in division. It relates the multiplication to the division. In this division game the preschooler groups the total number of items given. Nasimi (2011) points that online application showed great success in performance in preschoolers solving division sums. For example the preschooler is asked 16 ÷ 4 Myimaths application division game asks the preschooler, how many groups of 4 make 16? The preschooler has to share the 16 items in small groups of 4.

2.4.1 Myimaths Division grouping and acquisition of arithmetic proficiency

Myimath provides the preschooler with colorful pictorial representations to demonstrate to the preschooler on to how to solve division sums involving both grouping and sharing of items. According to Back (2011), children need lots of experiences with sharing physical objects out and expressing their actions in division in words and then in symbols. Chester (2017) states that through grouping and sharing of small quantities, preschoolers begin to understand division concepts and find simple fractions of objects, numbers and quantities. Back (2018) says that when preschoolers use grouping and sharing as different operations in solving problems division sums using concrete apparatus to help build the division concepts and the preschool relates sharing to grouping. The concept further develops and the preschoolers start to make connections between arrays, number patterns, and counting in twos, fives and tens

2.4.2 Myimaths Fractions and acquisition of arithmetic proficiency

Nelson (2015) states that teaching fractions using manipulatives objects, aid preschoolers with the concepts being concrete. She continues to say that to help preschoolers build fluency with their fractions skills she includes digitally tools for the preschoolers to practice. She adds that use of games and exploration with manipulatives helps preschoolers look forward to the lesson. The preschoolers find the fraction lessons and activity fun and interesting because the content is visual. Myimaths application has designed lessons and online homework activities for preschoolers that are designed to teach preschoolers on how to solve fraction sums. The application has interactive fruit fraction game that instructs preschooler to drags fruits and share them equally into boxes. The fruit fraction game starts with the preschoolers sharing the fruits into two boxes ½ then develops further to 4 boxes1/4. (Rezayirad, 2011)

2.5 Myimaths online games and acquisition of arithmetic proficiency

Dooley (2014) preschooler's engagement in play and playful activities provide the main contexts in which preschool mathematics learning takes place. The teaching and learning environment contributes to preschooler's performance. Online games with rules provide opportunities for collaborative learning and for the development of mathematical activities including reasoning, problem-solving, classifying and ordering. Online games activities contribute to the development of arithmetic proficiency such as conceptual understanding and productive disposition. Online games present valuable opportunities for observation and assessment of mathematical understanding and learning.

2.6 Teacher involvement and acquisition of arithmetic proficiency

Teachers' comments and rewarding systems boosted learners' participation and performance in arithmetic (Froiland, 2010). Teachers should reward learners as individuals in their personal progress, effort and achievement rather than compare them to others (Reeve, 2009). Teachers can adopt supportive teaching styles to teach because it motivates learners intrinsically. Peterson (2012) encourages learners to learn because of inherent benefits of learning personal growth and contribute to betterment t of the community. Teachers can teach parents to support leaners to foster intrinsic motivation in their children. Ryan & Deci, (2000) declares that supportive communication fosters intrinsic motivation in leaners.

2. 6 .1 Teachers attitudes, ICT knowledge and acquisition of arithmetic proficiency

Cady et. Al. (2011) points that teachers may develop negative attitudes towards the learning of and, thus, use of technology in the classroom. However, some who have positive attitudes towards the use of technology, lack technological knowledge, limiting the use of technology to its utility functions hence using Blackboards and textbooks. Crawford and Kirby (2007) observed that teacher's decision to incorporate digital technologies should occur in the context of content and pedagogy. Therefore, delivery of arithmetic content while using technology will depend on the teachers' attitudes and skills in ICT. Research has shown that teachers who do not feel ready and confident to use the technology are unlikely to integrate it in their pedagogy (Lau & Sim, 2008). Chigona& Chigona, (2010) notes that ratio of learners to a computer in the school's laboratory, and ICT policies in the schools, could demotivate educators from using the technology. Sylvia and Hutchinson (1985), educator motivation is based on the freedom to try new ideas, the achievement of appropriate responsibility levels, and intrinsic work elements.

2.7 Parental involvement and acquisition of arithmetic concepts

A research by Fan (2009) documents that parental involvement impacted positively on children's performance in students' mathematics proficiency and achievement. According to (Sheldon & Epstein 2005) the family and the community's participation helped in reducing chronic absenteeism which in turn improved students' academic performance. (Cooper & Nye, 2000 Parental support by following closely what that child is learning and expressing the challenges the parent faced when she or he was in school proved useful to learners and they in turn returned higher test scores and completed their homework. Parents should support their children by being empathetic and putting their children's feelings into consideration when children are facing challenges with their online homework however they should not do the homework for their children (Froiland, 2013)

2.8 Theoretical framework

This study seeks to investigate the influence of Myimaths application in preschoolers' arithmetic proficiency. Piaget theory of constructivism is deemed the most applicable theory to answer the research questions. According to Piaget constructivism is a theory of knowledge (epistemology) that argues that preschoolers and adults alike generate knowledge and meaning from an interaction between their experiences and their ideas from infancy. According to the theory through the processes of accommodation and assimilation, preschoolers construct new knowledge from their experiences. When preschoolers assimilate information, they incorporate the new experience into an already existing framework without changing that framework. According to the theory, accommodation is the process of reframing one's mental representation of the external world to fit new experiences. Bauersfeld (1995) states that the teacher becomes a facilitator helping the learner to get to his or her own understanding of the content in arithmetic.

In Myimaths application, teachers facilitates learning and are not sources of knowledge and skills. In this theory the emphasis is on the content, and towards the learner and not the instructor or teacher (Gamoran, Secada, & Marrett, 1998).

2.8.1 Constructivist Theory

According to Piaget (1869), learning involves construction and comprehension of knowledge. He claims that preschoolers construct knowledge and form meaning based on their experiences. Wadsworth (1989) Piaget's theory on logical mathematical knowledge is composed of the child's action. Therefore, teaching is based on constructivism, which is a logical theory dealing with epistemology. The basic principle of constructivist theories is that all knowledge is constructed by the individual, in the mind. It is directly relevant to teachers, for a teacher to teach well he or she must be able to understand how preschoolers learn, so that we can develop and employ methods that work.

Simon (1995) affirmed that constructivism theory is prominent in learning mathematics and has provided basis for further research in mathematics. Clement (2009) observed the Piagetian position that mathematical ideas are made by children, when a child is shown number four in relation to a set of four items the child constructs meaning of four. Preschoolers construct knowledge by relating with real objects explorations, thinking, and participation in discussions as making sense of, and communicating about mathematics. Preschoolers are encouraged to use their own methods for solving sums, they could solve the arithmetic sums mentally, using a number line, number bonds or using a number grid.

Wadsworth (1989 on Piaget's theory states that education methods need to be consistent with how children acquire knowledge. Therefore, interaction with Myimaths application offers the preschooler a conducive environment that allows him or her to construct knowledge in arithmetic.

A study carried by Bagon (2016) in Slovenia on Motivation for using ICT and pupils with learning difficulties, found out that pupils consider ICT an equally important motivation for learning and work at school and at home.

2.9 Conceptual Framework

The conceptual framework is based on Piaget's constructivism theory that encourages teachers to enrich the preschoolers' environment for them to interact and construct knowledge to boost performance in arithmetic. The use of Myimaths application resources; the number line, number grid Myimaths online games, the facilitators are teacher and parents involvement in teaching fosters cognitive reorganization resulting from assimilation and accommodation of new knowledge in arithmetic. Parental contribution of providing computers, Wi-Fi and assisting children to carry out Myimaths application online home continues help children make meaning in arithmetic and improve in their proficiency.

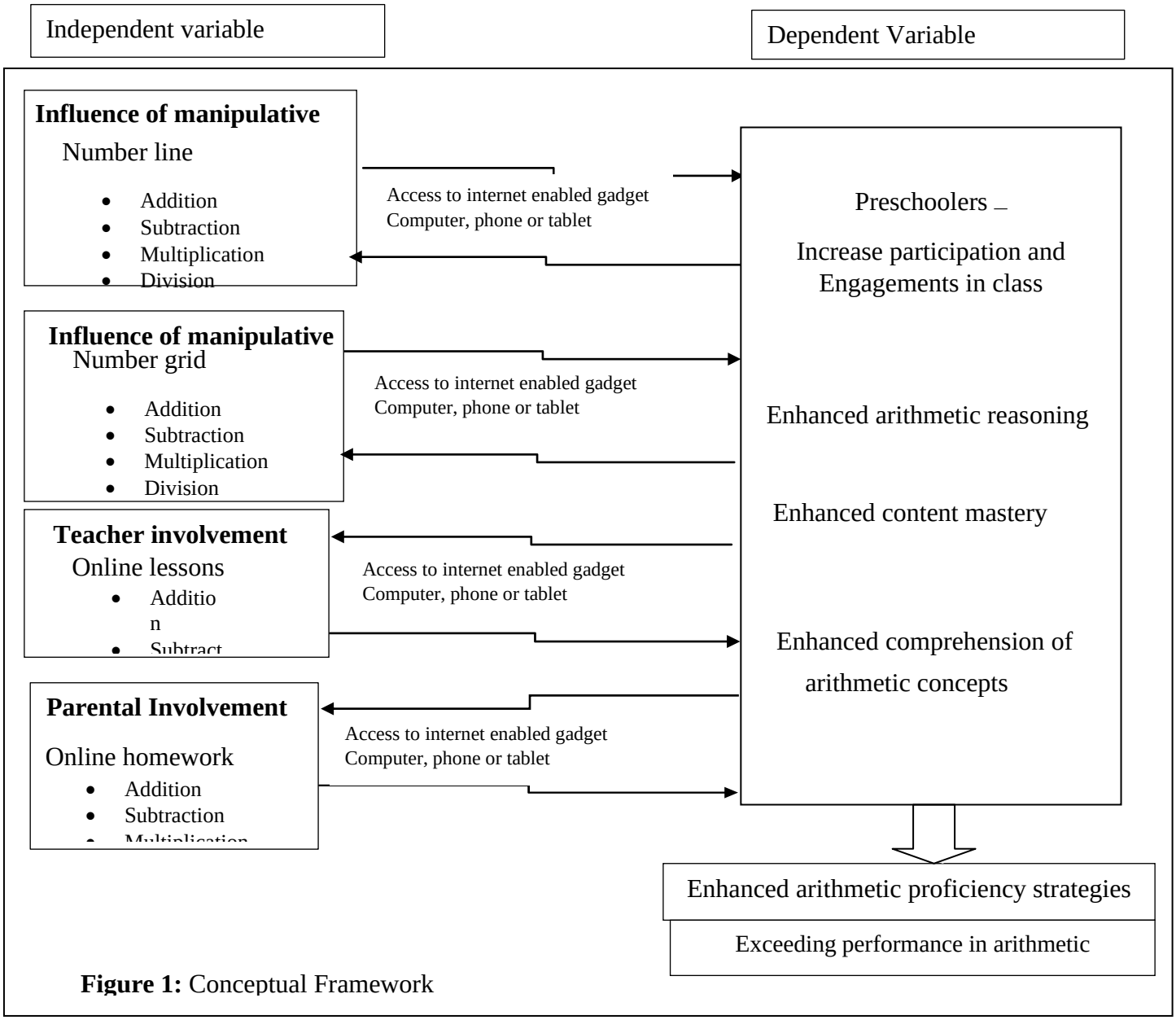

Figure 1: Conceptual Framework

Summary of gaps in related literature

Study	**Title**	**Methodology**	**Findings**	**Gaps**
Marcelo.C.B (2017)Digital Technology in Mathematics Education: Research over the last decade Crompton, H. et. & al (2015) Mobile Learning and mathematics. Foundations, design and case studies. Borba, M. C.,et&al (2014) Phases of digital technologies in mathematics education: The classroom and the internet in motion	Digital Technology in Mathematics Education: Research over the last decade	Survey	Use of mobile technologies in teaching and learning of mathematics is gaining interest among educational researchers and practitioners	The study does not focus on the use of online application in preschoolers arithmetic proficiency
Jarmila. R(2012)The impact of web sites on teaching and learning mathematics	The impact of web sites on teaching and learning mathematics	Survey		The study does not focus on the use of online application in preschoolers arithmetic proficiency
Hasan.K.(2019) A case study on		Case Study	The findings indicated that use	The study does not focus on the

online mathematics Teaching with pen-based technology			of digital pen in the online mathematical course was beneficial in pedagogical and interaction aspects. The pen helped in displaying the steps of solving mathematical problems.	use of online application in preschoolers arithmetic proficiency

CHAPTER THREE: METHODOLOGY

3.0 Introduction

This chapter described how the requisite data was obtained, processed and analyzed to realize study objectives. The items considered were research design, target population and sampling procedures. This was followed by processes of data collection, research instruments, techniques of data analysis, tests for reliability and validity of the instruments.

3.1 Research Design

Research design is the arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance to the purpose with economy in the procedure, Orodho (2016). The function of the research design is to provide for collection of relevant evidence with minimal expenditure of effort, money and time. The study applied mixed method research design. It included both descriptive survey design methods as data was generated using structured questionnaires, pre-tests and post-tests.

According to Orodho (2016), survey research deals with incidence, distribution and interrelations of educational variables. It does not emphasize the diverse aspects of a single case, but rather the frequency or number of answers to the same question by different people. He further points out that survey research gathers data with the intention of determining the relationship that exists between specific events, for example, whether there exists any relationship between learners' performance in mathematics and the use of Myimaths application.

The design compared the students' results in arithmetic proficiency before and after use of Myimaths application. Teachers and parents' opinions on influence of Myimaths on learner achievement and respective social impacts were collected and inferences made.

3.2 Target Population

Target population is theoretically specified aggregation of study elements (Mugenda and Mugenda, 2003). The study targeted preschools implementing the British National Curriculum schools in Dagoretti North Sub-county. Dagoretti North Sub-county was chosen for the study because of a large number of schools implementing British National Curriculum as compared to other sub-counties within Nairobi County. The schools have adequate infrastructure needed for teaching using online platforms. Within Dagoretti North sub-county, there are five schools implementing British National Curriculum which include Rusinga School, Breaburn Academy, Braeside Academy, St Austin's academy, Nairobi International School. Preschoolers from the schools and their respective teachers and parents were selected to participate in the study. Their views and attitudes towards online teaching platforms were important to gauge the effectiveness of such platforms in teaching mathematics to preschoolers.

3.3 Sampling procedure and Sample Size

Sampling is a process of selecting a number of individual or objects from a population such that the selected group contains elements representative of the characteristic found in the entire group (Orodho, 2009). A sample is thus a small proportion of population selected using some predetermined procedure. Sampling design is a definite plan determined before any data are collected for obtaining a sample from a given population.

The study applied purposive sampling technique because the study focused on preschools implementing the

British National Curriculum schools in Dagoretti North Sub County. Two preschools, one using Myimaths and one not using Myimaths were selected for the study. Preschool learners from both the selected schools were chosen for the pre-test and posttest exams that would measure the true influence of Myimaths on proficiency of arithmetic skills. The study assumed that preschool learners from both schools were developmentally ready to handle computers and could operate the search engine and navigate through to open and use Myimaths application. About 15 preschool learners were picked from both schools to participate in the study.

3.4 Research Instrument

Data collection instruments are used to record information pertaining to a particular phenomenon under study from a selected number of respondents (Orodho, 2016). The study carefully selected instruments that would capture relevant data pertaining to the influence of Myimaths in preschooler's acquisition of mathematical concepts. To establish the influence of the online application on preschool learners, structured close ended questionnaires and standardized tests were used to collect the information. The design of the tools was guided by the study objectives and the type of the population that was targeted.

A structured questionnaire is an instrument used to gather data, which allows measurements for or against a particular view point, (Orodho, 2016). Questionnaire was considered for collecting information on teachers and parents' views on Myimaths application as the targeted subjects were geographically far apart. Questionnaires relatively collect large amounts of information in a reasonably quick time.

Standardized tests were administered, scored and interpreted in a consistent procedure to gauge learner's arithmetic proficiency in using Myimaths application. Standardized tests provide an estimate of general intellectual level of sampling a person's performance on a variety of tasks, such as mathematical problem solving, (Orodho 2016). A written standardized test (pre-test and post-tests) was conducted on a group of preschoolers from both sampled school, to gauge their numerical reasoning before and after a mathematical lesson. In one school, the lesson was conducted with the use of Myimaths application while the other class, there was no Myimaths application. Both sets of learners were tested on addition, subtraction, multiplication and division.

3.5 Piloting of the Questionnaires

According to Orodho (2016) piloting the research instruments is done in order to highlight the deficiencies in the questionnaire. Piloting reveals vague questions and the researcher is able to able to rephrase them until they convey the same meaning to all the subjects. Piloting reveals the anticipated analytical techniques appropriate for the study. The questionnaire was pre-tested to a sample five randomly selected teachers from Rusinga School whom represented key attributes of the bigger sampling frame. The responses were analyzed with some turning blank spaces, inaccurate sentences, inconsistencies and other weaknesses of the instrument. The instrument was then revised further in readiness for data collection.

3.6 Reliability of the Instrument

Reliability is consistency, stability and ability to get the same results in performance. The results of a test are considered reliable if the performance obtained is consistent and identical even in different circumstances (Twycross & Shields, 2004). The study tests the children before and after the use of Myimaths application in arithmetic using the four operations of addition, subtraction,

multiplication and division. The tests were reliable because they measured the abilities of preschoolers in solving sums with the four operations that constitute arithmetic operations.

3.7 Instruments Validity

Validity is the extent to which any measuring instrument measures what it is intended to measure (Thatcher, 2010). To enhance content validity, the research instruments were appraised by my thesis supervisor who is an expert in early childhood education. His contributions and suggestions were used to clarify ambiguous questions. Study ensured that the four operations were in the instruments were represented and related to the study, covered all the important areas and objectives of the study and ascertained that each item measured only what it was purported to measure. Pilot survey was done in Rusinga School and data analyzed and used to fine tune and improve on questionnaire items.

3.8 Preparation for Data Collection

The student sought for an introductory letter from the University which was used to get a permit from National Council for Science and Technology (NCST). This was presented at County Director of Education office in Nairobi and Sub-county Education office in Dagoretti North who authorized the study. The student then reported to the two schools for briefing and consent on the intended study. The school managers then gave the researcher the permission to conduct the study and even drafted an email to the sampled parents assuring them of anonymity and confidentiality of the study and stressed the study was purely for academic purposes only. The student scheduled the appropriate dates for the tests with the relevant teachers of the sampled classes.

3.8.1 Procedures for Data Collection

The student distributed the questionnaires to the teachers and gave the sampled preschoolers the parent's questionnaires to take to their respective parents who in turn filled them and handed them back via their children. The student thereafter collected the questionnaires from the teacher who had volunteered to help the investigator with the collection of the instruments. The pre-tests and post-tests examinations were administered to the Preschoolers during the mathematical lessons and marked by their respective teachers for further analysis.

3.9 Data Analysis

Quantitative data was analyzed using Statistical Package for Social Science (SPSS). This was done in order to run descriptive analysis to produce frequency distribution and percentages while charts were produced using Ms-Excel. Scores of respondents in each item was extracted to give overall score and then converted to percentages expressed as fraction of the overall score. The collected data of pre-tests,post-tests and questionnaires was analyzed to assess the influence of Myimath on arithmetic proficiency in preschool learners. Analysis of variance was used on analyzing dataon manipulative number line and proficiency in arithmetic concepts

Qualitative analysis considered inferences that were made from views and opinions of respondents. Data was then summarized, organized according to research questions, arranged into themes and presented in narrative form and presented in tabular forms indicating averages, frequencies and percentages.

CHAPTER FOUR: FINDINGS AND DISCUSSIONS

4.0 Introduction

The results presented in this chapter have been structured into five thematic areas, including demographic information of the respondents, influence of manipulative number grid, influence of manipulative number line on acquisition of arithmetic proficiency, influence of teacher involvement in acquisition of arithmetic proficiency and influence of parental involvement in acquisition of arithmetic proficiency.

4.1 Demographic Information of Pre-school learners

The study focused on a total of 30 preschool learners from Rusinga School and St. Austin Academy. Each school had 15 pre-school learners who participated in the study. The analysis is presented in figure 1.

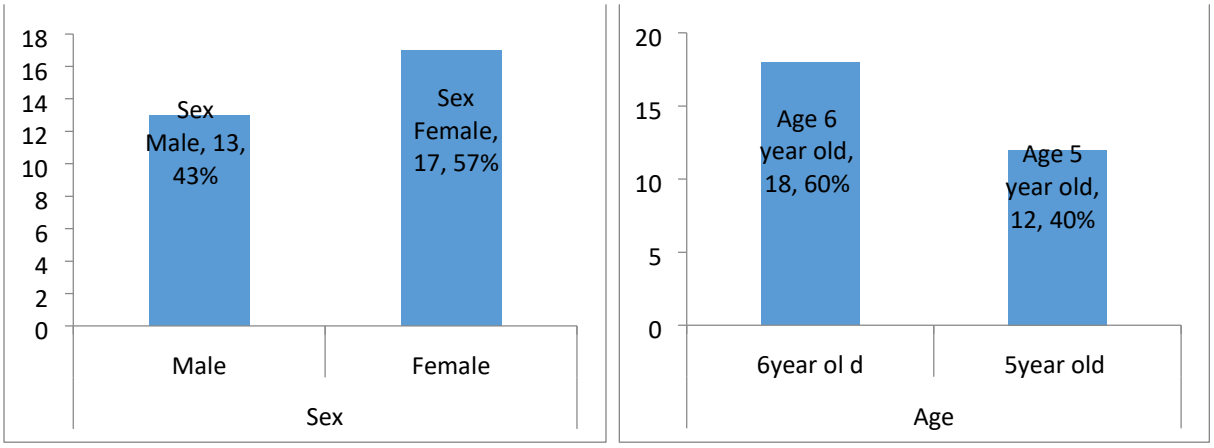

Figure 2: Demographic Information of Pre-School Learners

The study in figure 2 showed that 18 (60%) of the pre-school learners were aged 6 years while those aged 5 years were 12 (40%). The gender distribution of the learners indicated that 17 (57%) of the pre-school learners were females and 13 (43%) were males. The findings revealed that the

schools had a fair distribution of male and female learners and those aged 6 years were the majority. This confirmed that the schools had a fair enrollment of both male and female preschool learners and therefore would have enough exposure to technology required to navigate through Myimaths application.

4.2 Background Information of Teachers

Table 1:

Summary of Demographic Information of Pre-School Teachers

Demographic information	Characteristic	Frequency (N)	Percentage (%)
How many years have you taught at your current school?	3 to 5 years	2	29
	6 to 10 years	5	71
Mark the appropriate range for your age	20 to 30 years	2	28
	31 to 40 years	1	15
	41 and above	4	57
What level do you currently teach	Year 1	7	100
What are your ICT qualifications	Basic ICT qualification	7	100

The data in table 1 revealed that most of pre-school teachers Five, (71%) had taught at their respective schools for over 5 years indicating they had interacted with so many pre-schools learners and therefore was in a position to teach well. Four, (57%) were aged over 40 years, another indication they had attained requisite teaching experience and therefore were able to monitor the progress of preschool learners in arithmetic proficiency using Myimaths application.In addition, all the pre-school teachers had basic ICT qualifications which enabled them to administer the Myimaths application to learners with great confidence and understanding.

4.3 Manipulative Number line and proficiency in arithmetic concepts

The study sought to investigate the impact of Myimaths application number lines on the proficiency of arithmetic concepts by preschool learners. Preschool learners in both schools were given pre-arithmetic and post arithmetic tests in order to establish if they were able to provide solutions to the arithmetic problems using number present in the Myimaths application. Four questions were set in each category testing different arithmetic concepts of addition, subtraction, multiplication and division. The results of the preschool learners are presented in table 2.

Table 2: Frequency of Number line Pre-tests and Post-test

		Pre-Test						Post-Test					
School	Scores	(+)	(-)	(*)	(/)	Total (N)	Total (%)	(+)	(-)	(*)	(/)	Total (N)	Total (%)
RNS	0			2		2	8%			1		1	4%
	1	1		1	2	4	17%				3	3	13%
	2		1	1	1	3	13%		1			1	4%
	3	2	3	1	3	9	38%			2	1	3	13%
	4	3	2	1		6	25%	6	5	3	2	16	67%
	Total	6	6	6	6	24	100%	6	6	6	6	24	100%
SAA	0			1	4	5	18%				2	2	7%
	1			2	2	4	14%			4	1	5	18%
	2		2	3	1	6	21%			2	2	4	14%
	3		5	1		6	21%	1	1		1	3	11%
	4	7				7	25%	6	6	1	1	14	50%
	Total	7	7	7	7	28	100%	7	7	7	7	28	100%

The results presented in table 2 showed that there were more preschool learners scoring zero in pre-test than in post-test. For instance, preschool learners from Rusinga School who scored zero were two, (8%) in the pretest while in the post-test, they was only one, (4%). Equally, preschool learners from St. Austin's who scored zero in the pre-test were five, (18%) while in the post-test, only two, (7%) scored zero. The results indicated that number line improved performance in

arithmetic for learners in both Rusinga and St. Austin Academy. This was observed by Fryholm (2010) who stated that use of a number line improved performance in preschoolers on addition skills**.** He further added that number lines allowed preschoolers to develop mental addition skills as they actively construct mathematical meaning, number sense, and understandings of number relationships.

On the same breadth, the results showed that Myimaths number line improved the scores in each tests since the number of RNS preschoolers scoring 4 increased from 3 to 6 for addition, 2 to 5 for subtraction, 1 to 3 for multiplication and 0 to 2 for division. The results indicated that number line had significant impact on the four mathematical tests as confirmed by Maier and Rasmussen (2018), who indicated that number line is an easy tool for preschoolers to understand and is useful in assisting students understand the relative magnitude, position of numbers and visualize operations in addition.

Further, the results indicated that the mode of teaching arithmetic concepts in RNS had a significant improvement in all the categories of the post-test as indicated in table 3. The findings show there was significant improvements in the post tests between the two schools as compared to the pre-tests. The ANOVA tests at 95% chance produced an F-value of 6.728 (df = 1, p=0.015) for the post-test, indicating the both schools had significant differences in the post-test results.

Table 3:

Analysis of Number Line Means

ANOVA

			Sum of Squares	df	Mean Square	F	Sig.
Pre-Test	Between Groups	(Combined)	20.833	1	20.833	2.771	0.107
	Within Groups		210.533	28	7.519		

	Total		231.367	29			
Post-Test	Between Groups	(Combined)	28.033	1	28.033	6.728	0.015
	Within Groups		116.667	28	4.167		
	Total		144.7	29			

The results further show that number line produced an impact in the proficiency of mathematics effect on the manipulation of the mathematical problems tested. The mean for Myimaths number line pretest was 2.64 while that of post-test was 3.25. On the other hand, the mean for conventional number lines 2.21 while its respective post-test was 2.83. This indicated that Myimaths number line produced a relatively stronger impact as compared to the traditional number line. The same observation was affirmed by Dooley (2014), explained that digital tools assisted in the development of preschooler's mathematical proficiency, adaptive reasoning, strategic competence and productive disposition and therefore enhanced greatly learner proficiency in mathematical concepts compared to the traditional teacher led approaches. The results are presented in table 4.

Table 4:

Summary means of Number Line

School	Test_type	manipulative	Addition	Subtraction	Multiplication	Division	Total
RNS	Pre test	number line	3.29	3.29	2.00	2.00	2.64
	Post test	number line	4.00	3.67	3.00	2.33	3.25
SAA	Pretest	number line	4.00	2.71	1.57	.57	2.21
	Post test	number line	4.00	4.00	1.33	2.00	2.83

Moreover, the results in table 4 show that the mean for number line with regard to addition, subtraction and multiplication greatly increased compared to that of division. For instance, the

mean for pretest in addition was 3.29 while that of multiplication was 2 in Rusinga School while the mean for post-tests in the same texts was 4 and 3 respectively. The results proved Myimaths number line technique was significantly helpful in helping learners enhance their numerical proficiency.

Table 4 showed a comparative analysis of the traditional number line system and that of Myimaths. The same test was conducted on preschool learners who were not taught using Myimaths application as indicated in table 4. From the findings, the means of the various tests done without Myimaths application differed in all the four tests though not significantly large as compared to those done with the aid of Myimath application. The study equally compared the general performances of the two sets of preschool learners to determine if the concepts they had been taught were well captured. A t-test on the significance of number line further showed they were very significant in the concept of subtraction as reckon by Maier and Rasmussen (2018),who said that number line engages preschoolers in a systematic continual of numbers and helps in the representation of the number system that is ongoing, natural, and intuitive to preschoolers. He further stated that number line clarity and intuitive properties blend with existing cognitive structures, the number line is well suited to model subtraction problems, for example, that otherwise would require regrouping strategies common to block and algorithmic procedures.

Table 5: T-tests for Number Line in arithmetic proficiency

	Paired Differences					t	df	p-value
				95% CIof the Difference				
	Mean	Std. Dev.	Std. Error Mean	Lower	Upper			

Addition	-.308	.947	.263	-.880	.265	-1.171	12	.264
Subtraction	-.846	.899	.249	-1.389	-.303	-3.395	12	.005
Multiplication	-.692	1.601	.444	-1.660	.275	-1.559	12	.145
Division	-.846	1.463	.406	-1.730	.038	-2.085	12	.059

4.4 Manipulative Number Grid on proficiency of arithmetic concepts

The study sought to investigate the impact of Myimaths application number grid on the proficiency of arithmetic concepts by preschool learners. Preschool learners in both schools were given number grid pre-arithmetic and post arithmetic tests in order to establish if they were able to provide solutions to the arithmetic problems using number present in the Myimaths application. Four questions were set in each category testing different arithmetic concepts of addition, subtraction, multiplication and division. The results of the preschool learners are presented in table 6.

Table 6: Frequency distribution table of Number Grid Pre-tests and Post-test

School		**(+)**	**(-)**	**(*)**	**(/)**	**Total (N)**	**Total (%)**	**(+)**	**(-)**	**(*)**	**(/)**	**Total (N)**	**Total (%)**
RNS	0		1		3	4	11%				3	3	8%
	1			2	2	4	11%				1	1	3%
	2		3	2	2	7	19%		1	1		2	6%
	3		2	1	2	5	14%		2	2	3	7	19%
	4	9	3	4		16	44%	9	6	6	2	23	64%
	Total	9	9	9	9	36	100%	9	9	9	9	36	100%
SAA	0			3	5	8	25%				3	3	9%
	1		1	2		3	9%			1	2	3	9%
	2	1	2	1	1	5	16%		2		3	5	16%
	3	1	4	2	1	8	25%	1	6	1		8	25%
	4	6	1		1	8	25%	7		6		13	41%
	Total	8	8	8	8	32	100%	8	8	8	8	32	100%

The results presented in table 6 above showed that there were more preschool learners scoring zero and one in pre-test than in post-test. For instance, preschool learners from Rusinga School who scored zero were four, (11%) in the pretest while in the post-test, they were three, (8%). Equally, preschool learners from St. Austin who scored zero in the pre-test were eight, (25%) while in the post-test, three, (9%) scored zero. The results indicated that number grid improved performance in arithmetic for learners in both Rusinga School and St. Austin Academy.

On the same note, the results showed that Myimaths number grid improved the scores in each tests since the number of RNS preschoolers scoring 4 increased from 3 to 6 for subtraction, 4 to 6 for multiplication and0 to 2 for division. Further, the results indicated that the difference in the tests done the preschoolers on number grid was not significant. The ANOVA tests at 95% chance produced an F-value of 3.811 (df = 1, p=0.070) for the post-test, indicating the both testsdid not produce significantly large difference in their overall scores.

Table 7:
ANOVA for Number Grid

		Sum of Squares	df	Mean Square	F	Sig.
Pre Test Total	Between Groups	19.628	1	19.628	1.802	.199
	Within Groups	163.431	15	10.895		
	Total	183.059	16			
Post Test total	Between Groups	16.707	1	16.707	3.811	.070
	Within Groups	65.764	15	4.384		
	Total	82.471	16			

The results further showed that number grid had a significant impact on the concept of multiplication as shown in table 8. The impact on the concepts of addition, subtraction and division were not significant. The results were affirmed by Prodigy (2018) who stated that Preschoolers learn multiplication better when the concept is introduced as repeated addition. Number grid

introduces the concept of multiplication as a table of groups of items and pictures and translatedas repeated addition. This enhanced the learner's proficiency in solving multiplication as shown in the table 8 below.

Table 8:

T- Tests for Number grid

	Paired Differences					t	df	p-value
				95% CI Difference				
	Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Addition	-.118	.600	.146	-.426	.191	-.808	16	.431
Subtraction	-.529	1.231	.298	-1.162	.103	-1.774	16	.095
Multiplication	-1.471	1.505	.365	-2.244	-.697	-4.029	16	.001
Division	-.294	1.572	.381	-1.102	.514	-.772	16	.452

On the same note, Myimaths number grid had an impact on the concepts of addition, subtraction and multiplication as the means in each category greatly improved in the post-tests. The results indicated that both number line and number grids were vital in building of mathematical concepts in preschool learners. Number grid was particularly significant in building multiplication concept as shown in table 9 below.

Table 9:

Summary means of Number grid

school	test_type	manipulative	addition	subtraction	multiplication	division	Total
RNS	Pretest	number grid	4.00	2.50	2.63	1.13	2.56
	Post test	number grid	4.00	3.56	3.56	2.00	3.28
SAA	Pretest	number grid	3.63	2.63	1.25	1.13	2.16

Post test	number grid	3.78	2.78	3.56	.89	2.75
Total	number grid	3.85	2.88	2.79	1.29	2.71

4.4 ICT infrastructure for Myimaths application

The study sought to investigate the basic ICT components needed for effective teaching using Myimaths application that would enhance learner achievement in mathematical concepts. From the study, all the teachers from Rusinga School noted they had been provided with desktops computers and in addition, 1 (14%) indicated they had personal laptops and thereby could access the Myimaths application from a remote location. The results are presented in table 10.

Table 10: Myimath ICT infrastructure

Infrastructural support for Myimaths		**Frequency**	**Percent**
Do you have desktops	Yes	7	100
Do you have a tablet	No	7	100
Do you have laptops	Yes	1	14.3
	No	6	85.7
Is poor network arising using technology and software applications in Myimaths	Yes	5	71.4
	No	2	28.6
Is internet downtime arising using technology and software applications in Myimaths	Yes	4	57.1
	No	3	42.9
Is poor server connections arising using technology and software applications in Myimaths	Yes	5	71.4
	No	2	28.6
Is server troubleshooting arising using technology and software applications in Myimaths	Yes	2	28.6
	No	5	71.4
Is login troubles arising using technology and software applications in Myimaths	Yes	3	42.9
	No	4	57.1
Is forgetting passwords arising using technology and software applications in Myimaths	Yes	5	71.4
	No	2	28.6
Is popup blockages arising using technology and software applications in Myimaths	No	7	100

The study revealed that some teachers experienced some technological challenges that arose from the use of the application. Five, (71%) teachers in Rusinga School admitted to poor network issues while four, (57%) admitted to internet downtime. Five, (71%) also admitted to forgetting passwords while logging into the application and two, (28%) admitted they had to troubleshoot the server every time they logged onto the Myimaths application.

Equally, all the parents interviewed admitted to have computers at home that was connected to the internet. This enabled their children to access Myimaths application at home and do arithmetic homework as well. It enabled the parents to assess their children's performance at home while performing arithmetic operations at home. Table 11 presents the results of home internet access.

Table 11: Home Internet Access

		Frequency	Percent
I have a computer with internet connected at home to support online learning Myimaths	Yes	11	100
	No	0	0

4.5 Frequency of using Myimaths in teaching mathematics

The survey sought to establish the mode of usage of the application in teaching learning process. The frequency metrics showed that majority of teachers of 5(67%) admitted they used Myimaths activities once a week. Few teachers however used the Myimaths lesson in every mathematical lesson. On the same note, teachers noted they preferred using Myimaths online lessons and Myimaths games in teaching at least one mathematical lesson in a week. The results are presented in table 12

Table 12: Frequency of usage of Myimaths in lesson class

Myimaths in lesson class	Yes	No
I use Myimaths activities during every mathematics lesson	1, 17%	6, 83%
I use Myimaths activities at least one lesson per week	5, 67%	2, 33%
I use Myimaths activities once a month	1, 17%	6, 83%
I never use Myimaths	6, 17%	6, 83%

The study sought to determine how much time parents allocated for helping their children with the homework. The findings showed that majority of 7 (64%) spent between 30 to 60 minutes of their time to help out their children with homework. The results are presented in figure 3.

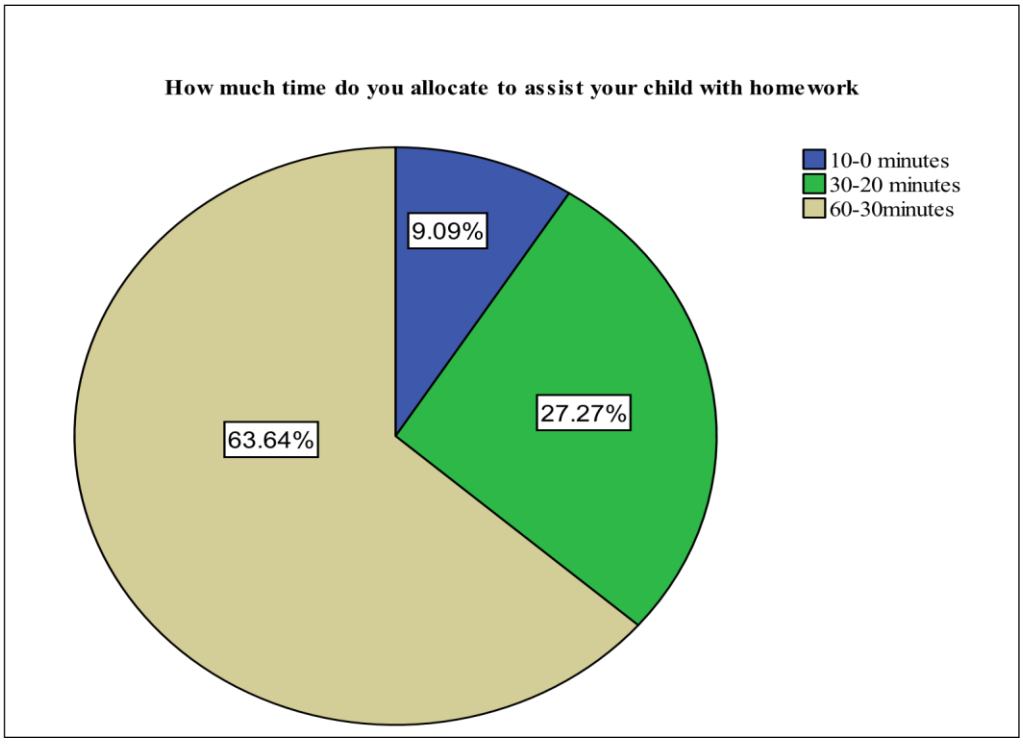

Figure 3: Parental time allocation

The findings proved that parents were actively involved in their children's education.

Equally, the study sought to establish factors that defined the success of Myimaths application environment. Teachers noted that factors such as availability of computers and relevant accessories such as internet and relevant computer skills for both teachers and learners were essential in for a successful Myimaths lesson. The results are presented in table 13.

Table 13:

Computer influence in learning arithmetic

Learning arithmetic	**Yes**	**No**
Does a computer influence the learner's performance in arithmetic affect performance	3, 50%	3, 50%
Does teacher computer skills influence the learners performance in arithmetic	4, 67%	2, 33%
Does learner computer skills influence the learners performance in arithmetic	7, 100%	0
Does internet access influence the learners performance in arithmetic	4, 67%	3, 33%

From the findings, 3(50%) of teachers believed computers had an influence on learner's performance in arithmetic. Four, (67%) believed computer skills had an influence on learner's performance in arithmetic while four, (67%) said internet access was important factor in learner's performance in arithmetic.

4.6 Teacher involvement of Myimaths Application

The study sought to establish teacher perception of the application for teaching and learning mathematics since they were the primary administrators of the application and therefore their overall perception on the application would be a major factor that determines the success of the application in the teaching-learning process.

The results on teacher perception on Myimaths application are presented in table 14.

Table 14:

Teacher Perception on Myimaths App

Myimaths APP	**Agree**	**Disagree**
Myimaths application during teaching and learning arithmetic improves arithmetic proficiency	4,67%	2,33%
Knowledge of computer skills influences learning achievement in Myimaths	5, 83%	1, 17%
Using computers results greatly to efficiency of instructions during Myimaths lessons	6, 100%	0 %
Using Myimaths prepares learners better to acquire arithmetic activities	4, 67%	2, 33%
Clear concepts instructions help learners to grasp quickly arithmetic concepts using Myimaths	3, 50%	3, 50%
Teacher guided Myimaths instructions results in higher learning achievements	3, 50%	3, 50%
Learner's interest in addition activities are enhanced while using Myimaths application	6, 100%	0 %
Learner's interest in subtraction activities are enhanced while using Myimaths application	6, 100%	0 %
Learner's interest in multiplication activities are enhanced while using Myimaths application	6, 100%	0 %

Learner's interest in division activities are enhanced while using Myimaths application	6, 100%	0 %
Leaner's prefer to attempt Myimaths online activities more times than written work	3, 50%	3, 50%
Leaner's enjoy learning arithmetic skills using Myimaths application	4, 67%	2, 33%
Myimaths supports teachers in teaching arithmetic	6, 100%	0 %
Leaner's in the class I teach have a computer, laptop or tablet at home with internet access	6, 100%	0 %
Technology is an integral part of the overall education programme	6, 100%	0%
Learners would master arithmetic concepts if the Myimaths activities were more child friendly	5, 83%	1, 17%

From the findings, majority of teachers positively agreed with the metrics asked. On being asked about the relevance of the application, 4 (67%) agreed the computer application improved arithmetic proficiency and a similar proportion agreed that using Myimaths application prepared learners to better acquire arithmetic activities. Equally, all the teachers agreed that Myimaths supported teachers in teaching arithmetic.

The study sought teacher perception on the instructional support the application was offering and about half of the teachers admitted teacher guided Myimaths instructions resulted in higher learning achievements and equally, 3(50%) said that the clear concepts instructions embedded in the Myimaths helped learners grasp quickly the arithmetic concepts. This revealed that Myimaths needed improvements with regard to instructional support for majority to understand better. The findings revealed that Myimaths made teaching-learning process interesting as the leaner's interest in arithmetic skills were greatly enhanced. All teachers 7,(100%) agreed that learner's interest in addition, subtraction, multiplication and division activities were enhanced while using Myimaths

lessons. This indicated that Myimaths application captured learner's interest since it fully engaged the learner's senses and therefore was able to quickly capture the arithmetic concepts.

The study equally sought to establish learner's preferences in the Myimaths application. The findings revealed that about 3 (50%) of teachers noted leaners preferred to attempt Myimaths online activities more times than written work and 4 (67%) noted that learners enjoyed learning arithmetic skills using Myimaths application. This revealed there was a gap between learner's expectation of the Myimaths and teacher's expectation with regard to learner achievement in arithmetic's. On the same breadth, 83% of teachers noted that learners would master arithmetic concepts if the Myimaths activity was more children friendly. The same sentiments were echoed by some parents who noted that learners under 6 years were too young for the technology, an indication that Myimaths was somewhat not very friendly to children and therefore should be mostly used by learners of higher cadre.

The study further revealed that all teachers agreed that technology was an integral part of the overall education program and using computers in the teaching and learning process of mathematics resulted greatly to high learner achievement.

4.7 Parental involvement of Myimaths Application

The study sought to establish parents' attitude towards the Myimaths application. The results on parents' attitude to Myimaths application is presented in table 15.

Table 15: Parent involvement of Myimaths

Parent Involvement	Agree	Disagree
Myimaths homework helps my child improve in addition skills	6, 55%	5, 45%
Myimaths online homework has advanced my child's performance in subtraction	7, 64%	4, 36%
Myimaths online homework enhances my child's mastery of multiplication skills	9, 82%	2, 18%
Myimaths online homework boosts my child's performance in division	7, 64%	4, 36%
Myimaths online homework challenges my child's arithmetic knowledge	6, 60%	4, 40%
Myimaths homework has boosted my child's ability to be independent in arithmetic proficiency	6, 55%	5, 45%
I actively participate in helping my child complete his/her online homework	4, 36%	7, 64%
My child usually enjoys doing his/her online Myimaths homework	6, 55%	5, 45%
Online Number lines help my child solve addition sums with ease	7, 64%	4, 36%
Online Number lines help my child solve subtraction sums with ease	7, 64%	4, 36%
Online number grids help my child with addition and subtraction	7, 64%	4, 36%

From the findings, 6 (55%) agreed the application helped their children improve in addition skills, 7 (64%) admitted the application advanced their children's performance in subtraction and 9(82%) noted that Myimaths online homework enhanced their children's mastery of multiplication skills. Equally, 7 (64%) said Myimaths online homework boosted their child's performance in division skills. The findings indicated that parents felt Myimaths application was a successful medium of

teaching-learning process for mathematics and they were confident it enhanced their children's achievement. In particular, over 7 (64%) of parents interviewed highlighted that number lines and number grids helped their children solve arithmetic challenges with ease and thus enhance the learner interest in completing the mathematics home assignments given by teachers.

Equally, 6 (60%) of parents believed that Myimaths online homework challenged their child's arithmetic knowledge and as a result their children's ability to be independent in arithmetic proficiency was greatly enhanced. However, only 4 (36%) admitted to actively participate in helping their child complete the online homework. This showed that many parents were mere spectators in the process of doing online homework since they allocated some time to help their children with the homework but were not very actively involved. This was because they believed that Myimaths made their children more independent in solving arithmetic problems and therefore required less assistance.

CHAPTER 5: SUMMARY CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The chapter aims at presenting the summaries of study findings followed by conclusions. Further it outlines the recommendations and finally it gives suggestions on areas for further studies.

5.2 Summary

From the findings, manipulative number line was found to influence the acquisition of arithmetic concepts. The post tests revealed that preschool learners were able to tackle arithmetic problems that they could not in the pre-test. Number line was particularly influential in building the concept of multiplication. Equally, learners were able to tackle some division problems though not very significant.

Preschool learners were able to solve mathematical problems using the number grid. In particular, number grid was very important in building multiplication concept in preschool learners.

The study affirmed that preschool teachers appreciated technology that helped them deliver content instruction to learners more easily. They found the application to be more interesting to the learners and therefore captured their interest during the teaching of mathematical concepts resulting in high learner achievement. Learners were found to attempt Myimaths online activities on a regular basis and therefore teachers could offer assignments via the tool.

The study revealed parents were confident in Myimaths as a necessary online tool for learning mathematics. They believed the tool enhanced leaner proficiency in arithmetic concepts and

therefore was necessary for expanding learner's knowledge in mathematics. Parents believed Myimaths online homework enhanced their children's mastery of multiplication and division skills thereby boosting their performances.

The findings indicated most parents spent at least 10 minutes of their time on a daily basis helping out their children complete the homework.

From the findings we can conclude that:

Number lines and number grids in particular helped their children solve arithmetic challenges with ease and thus enhance the learner interest in completing the mathematics home assignments given by teachers

The findings revealed that number grid had an influence in the acquisition of mathematical concepts such as subtraction.

Myimath in particular was a computer application that improved arithmetic proficiency in preschool learners and therefore offered vital support to teachers in teaching arithmetic.

Parents were getting involved in their children's academic work as they believed that preschool learners needed some support.

5.3 Recommendations and Implementations'

Preschoolers in both BNC and 2-3-3-3 curriculum should be introduced to online platforms that introduce, teach and reinforce the arithmetic operations and skills. Mathematic online platforms

with child friendly and manipulative number lines, number grid and games will boost learners' proficiency in solving addition, subtraction, multiplication and division skills with ease.

The Ministry of Education in conjunction with Kenya institute of curriculum development will develop policy frameworks on the effectiveness of proficiency of arithmetic concepts of preschoolers.

Further research in this area is needed to be concerned with sensitizing the government of Kenya to introduce Math's online application to boost mastery and proficiency in arithmetic

5.4 Contribution to body of Knowledge

Objective	Contribution
Manipulative number line on proficiency of arithmetic concepts	Number line was particularly influential in building the concept of multiplication. learners were able to tackle some division problems though not very significant.
Manipulative number grid on proficiency of arithmetic concepts	Preschool learners were able to solve mathematical problems using the number grid. Number grid was very important in building multiplication concept in preschool learners.

Teacher involvement and proficiency of arithmetic concepts	teachers appreciated technology that helped them deliver content instruction to learners more easily.
Parental involvement and proficiency of arithmetic concepts	Parents believed Myimaths online homework enhanced their children's mastery of multiplication and division skills thereby boosting their performances.

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Appendix I

Arithmetic Pre Test – Number Line

The Study intends to identify the influence of Myimaths Mathematical Application on acquisition of arithmetic operation proficiency in Preschools implementing the British National Curriculum in Dagoretti North Sub County.

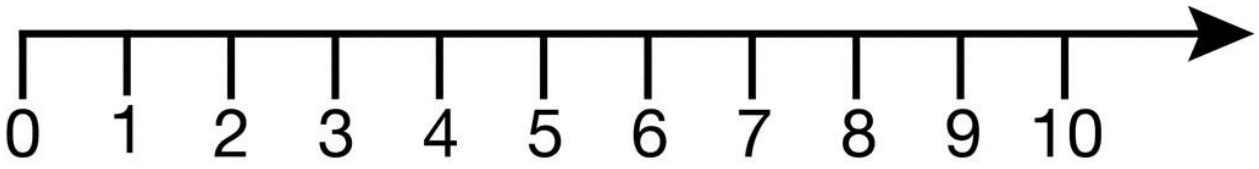
School Code: _____ **Child'sNumber Code _____**

Age: _____ **Gender**: _____ **Date** : _____

The teacher to guide learners in solving the sums listed.

Instructions: Use the number line to work out the sums.

1+ 1 =	2 + 2 =
2 - 2 =	4 – 3=
3× 1 =	4 × 1 =
2÷ 1 =	6 ÷ 2 =
1+ 4 =	5+ 4 =
4 - 2 =	9 – 3 =
2 × 3 =	2 × 2 =
4 ÷ 2 =	10 ÷ 2 =



Appendix II

Arithmetic Pre Test – Number Grid

The Study intends to identify the influence of Myimaths Mathematical Application on acquisition of arithmetic operation proficiency in Preschools implementing the British National Curriculum in Dagoretti North Sub County.

School Code: _____ **Child'sNumber code**: _____

Age:_____ **Gender**: _____ Date : _____

The teacher to guide learners in solving the sums listed.

Instructions: Use the number grid to work out the sums.

1+ 1 =	2 + 2 =
2 - 2 =	4 – 3=
3× 1 =	4 × 1 =
2÷ 1 =	6 ÷ 2 =
1+ 4 =	5+ 4 =
4 - 2 =	9 – 3 =
2 × 3 =	2 × 2 =
4 ÷ 2 =	10 ÷ 2 =

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Appendix III

Arithmetic Post Test – Number Line

The Study intends to identify the influence of Myimaths Mathematical Application on acquisition of arithmetic operation proficiency in Preschools implementing the British National Curriculum in Dagoretti North Sub County.

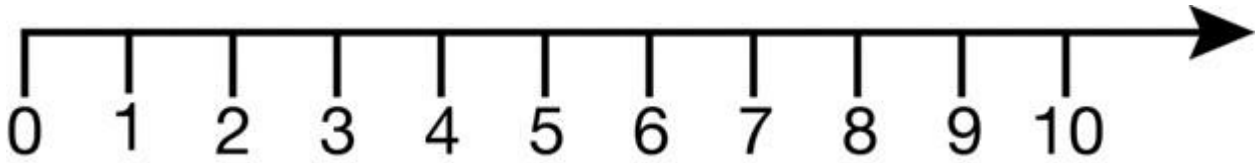
School Code: _____ **Child's Number Code**: _____

Age:_____ **Gender**: _____ Date: _____

(The teacher to guide learners in solving the sums listed.)

Instructions: Use the number line to work out the sums.

1+ 1 =	2 + 2 =
2 - 2 =	4 – 3=
3× 1 =	4 × 1 =
2÷ 1 =	6 ÷ 2 =
1+ 4 =	5+ 4 =
4 - 2 =	9 – 3 =
2 × 3 =	2 × 2 =



Appendix IV

Arithmetic Post Test – Number Grid

The Study intends to identify the influence of Myimaths Mathematical Application on acquisition of arithmetic operation proficiency in Preschools implementing the British National Curriculum in Dagoretti North Sub County.

School Code: _____ **Child's Number Code**: _____

Age :_____ **Gender**: _____ Date : _____

The teacher to guide learners in solving the sums listed.

Instructions: Use the number grid to work out the sums.

1+ 1 =	2 + 2 =
2 - 2 =	4 – 3=
3× 1 =	4 × 1 =
2÷ 1 =	4 ÷ 2 =
1+ 4 =	5+ 4 =
1- 2 =	9 – 3 =
2 × 3 =	2 × 2 =
4 ÷ 2 =	10 ÷ 2 =

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Appendix V

TEACHER QUESTIONAIRE

The Study intends to identify the influence of Myimaths Mathematical Application on acquisition of arithmetic concepts proficiency in Preschools implementing the British National Curriculum in Dagoretti North Sub County.

Background Information

1. How many years have you taught at your current school?

   ☐1-2 years

   ☐3-5 years

   ☐5-10 years

2. Please mark the appropriate range for your age.

   ☐20-30

   ☐31-40

   ☐41 and above

3. What level do you currently teach?

   ☐Kindergarten 1

   ☐Kindergarten 2

   ☐Year 1

4. What are your ICT qualifications? ☐Basic ICT qualifications

   ☐Advanced ICT qualifications

   ☐None

Tick the appropriate response

	Yes	No
Indicate the availability of the school ICT infrastructure in support of teaching Myimaths		
Desktops		
Tablets		
Laptops		
All		
Issues arising using technology and software applications in Myimaths		
Poor network		
Internet downtime		
Poor server connections		
Server troubleshooting		
Login troubles		
Forgetting passwords		
Popup blockages		
I use Myimaths activities during class and after class		
Every Mathematics lesson		
One Mathematics lesson per week		
One lesson in a month		
Never		
I prefer using Myimaths online lessons during mathematics lessons		
…….. …… …… ……..		
I use Myimaths games in teaching arithmetic concepts		
Every Numeracy lesson		
Once a week		
Once a month		
Never		
The following influences the learner's performance in arithmetic affects performance		
Computers		
Computer skills for teachers		

Computer skills for children		
Internet access		

Please read the statements and tick appropriately.

Statements	**Strongly Agree**	**Agree**	**Disagree**	**Strongly Disagree**	**Never**
Myimaths application during teaching and learning arithmetic improves arithmetic proficiency					
Knowledge of computer skills influences learning achievement in Myimaths					
Using computers results greatly to efficiency of instructions during Myimaths lessons					
Using Myimaths prepares learners better to acquire arithmetic activities					
Clear concepts instructions help learners to grasp quickly arithmetic concepts using Myimaths					
Teacher guided Myimaths instructions results in higher learning achievements					
Learners interests in addition activities are enhanced while using Myimaths application					
Learners interests in subtraction activities are enhanced while using Myimaths application					
Learners interests in multiplication activities are enhanced while using Myimaths application					
Learners interests in division activities are enhanced while using Myimaths application					
Learners prefer to attempt Myimaths online activities more times than written work					
Leaners enjoy learning arithmetic skills using Myimaths application					
Myimaths supports teachers in teaching arithmetic					
Leaners in the class I teach have a computer, laptop or tablet at home with internet access					
Technology is an integral part of the overall education program					
Leaners would master arithmetic concepts if the Myimaths activities were more child friendly					

Suggestions on how to improvearithmetic proficiency:

1. ……
2. ……
3. ……
4. ……
5. ……

Appendix VI

PARENT QUESTIONNAIRE

The Study intends to identify the influence of Myimaths Mathematical Application on acquisition of arithmetic concepts proficiency in Preschools implementing the British National Curriculum in Dagoretti North Sub County.

Kindly assist in filling this questionnaire to help the student with her research in the influence of Myimath on arithmetic proficiency

Tick the appropriate response

	Yes	No
I am a parent to a preschooler aged		
4 – 5 years		
5 – 6 years		
6 – 7 years		
I allocate this time from my busy schedule to assist your child with homework? _____ _____		
10 – 0 Minutes		
20 – 10 Minutes		
30 – 20 Minutes		
60 – 30 Minutes		
In your opinion should 5 – 6 year olds be given Myimaths (online) homework?		
Give a reason for your response _____ _____ _____		
I have a computer with internet connect at home to support online learning (Myimaths)		

Read the statements and tick appropriately

Statements	**Strongly Agree**	**Agree**	**Disagree**	**Strongly Disagree**	**Never**
Myimaths homework helps my child improve in Addition skills					
Myimaths online homework has advanced my child's performance in subtraction					
Myimaths online homework enhances my child's mastery of multiplication skills					
Myimaths on line homework boosts my child's performance in division					
Myimaths online homework challenges my child's arithmetic knowledge					
Online Myimaths homework has boosted my child's ability to be independent in arithmetic proficiency					
I actively participate in helping my child complete his/her online Myimaths homework					
My child usually enjoys doing his/her online Myimaths homework					
Online number lines help my child solve addition sums with ease					
Online number lines help my child solve subtraction sums with ease					
Online number grids help my child with addition and subtraction					

Suggestions on how to improve in arithmetic proficiency

1. ……

2. ……

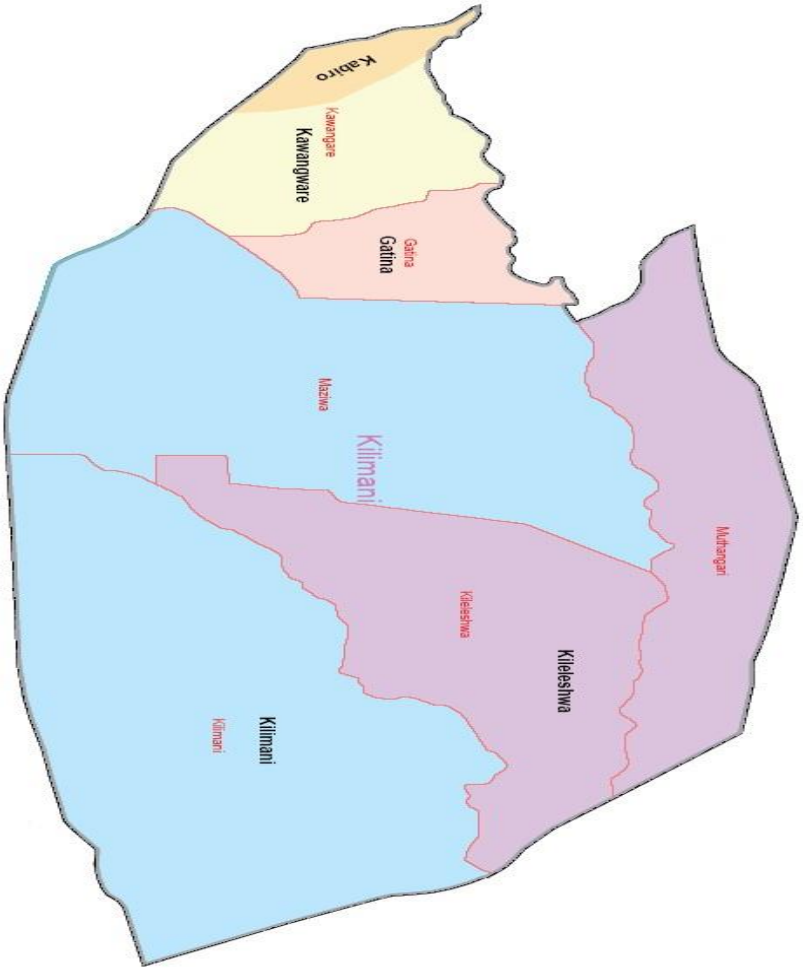
3. ……

4. ……

5. ……

Appendix VII

DAGORETTI NORTH SUB COUNTY MAP



Preschools implementing British National Curriculum in Dagoretti North Sub – County

Rusinga

Braeburn

Braeside

St.Austin's Academy Nairobi

International

UNIVERSITY OF NAIROBI

COLLEGE OF EDUCATION & EXTERNAL STUDIES

SCHOOL OF EDUCATION

DEPARTMENT OF EDUCATIONAL COMMUNICATION & TECHNOLOGY

Telephone: 020-2500759, 020-2500760
NAIROBI

P.O. BOX 30197, 00100

020-2500762, 020-2460056

P.O. BOX 92, 00902 KIKUYU

11th MARCH 2019

TO WHOM IT MAY CONCERN

RE: GATHARA IRENE WAMBUI REG No: – E57/71981/2011

This is to certify that **Gathara Irene Wambui Reg. number E57/71981/2011** is a student of the University of Nairobi, Department of Educational Communication and Technology pursuing M.Ed degree in Early Childhood Education. Her project is titled **"INFLUENCE OF MYIMATHS MATHEMATICAL APPLICATION ON ACQUISITION OF ARTIHMETIC CONCEPTS PROFICIENCY IN PRESCHOOLS IMPEMENTING THE BRITISH NATIONAL CURRICULUM IN DAGORETI NORTH SUB COUNTY"**

Any assistance accorded to her will be highly appreciated.

Yours faithfully,

Chairman
1 MAR 2019

PROF. FAUSTA ODUNDO
DEPARTMENT OF EDUCATIONAL COMMUNICATION AND TECHNOLOGY