INFLUENCE OF MODELLED TEACHING RESOURCES ON LEARNER ACHIEVEMENT IN COUNTING NUMBERS IN EARLY YEARS EDUCATION IN MUKURU KAYABA, NAIROBI COUNTY

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DECLARATION

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

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To my children, Stephen, Michelle, Victor, Lucille, Billiard and Gilbert and my grandchildren Marie, Laker and Israel, for their unequivocal support during my entire period of Studies.

ABSTRACT

The purpose of this study, Influence of modeled teaching resources on learner achievement in counting numbers in early year's education in Mukuru Kayaba informal settlements, Nairobi County, is to determine the effect of modeled instructional resources on preschooler's performance in counting numbers in Mukuru Kayaba. The study is anchored on the constructivist theory, whose proponent Jean Piaget, suggests that learners construct knowledge and meaning from their experiences and teachers act as facilitators and not main source of knowledge. In order to achieve this, the study is guided by the following objectives: to investigate motivation methodology, to determine the influence of modeled teaching resources on learner achievement in counting numbers, to establish the frequency of use of modeled teaching resources on learner achievement in counting numbers, to examine the influence of teacher attitude on modeled teaching resources in learner achievement in counting numbers and to determine learner performance in counting numbers using modeled teaching resources. In order to address the objectives, the study adopted a descriptive research design. Three public early year education schools were systematically sampled, while 48 preschool learners and 8 teachers were selected using random sampling technique. The research used pretest and posttest, classroom observation schedule and interview guide as research instruments to collect the data. The research instruments were first appraised by the supervisors for validity, then pilot tested for reliability. Data analysis and processing involved editing, coding and thematic categorization of data. Quantitative data was pooled for overall scores, ran through SPSS version 17 for frequencies and percentages and was then presented in tables. Qualitative data was however, summarized, thematically, arranged and presented in narrative form. The findings establish that modeled teaching resources are effective instructional tools for delivering mathematical concepts such as counting. All teachers (N=7, 100%) in Mukuru Kayaba use modeled instructional resources in their mathematical lessons. The major challenges towards the usage of modeled instructional resource are inadequate storage facility (N=6, 86%), small class room size (N=2, 29%), non-uniform enrollment (N=4, 57%), lack of time for developing modeled instructional resource (N = 3, 43%) and lack of class control (N = 3, 43%). The results further establish that the usage of modeled instructional resources has a significant effect on early year learner's performance in counting numbers ($r = 0.599$, p-value = 0.009). The study recommends that the county governments in Kenya and other policy institutions on early year education should develop effective policies, support and training on the importance of modeled teaching resources towards preschooler's attainment and mastery of mathematical concepts.

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LIST OF ABBREVIATIONS AND ACRONYMS

CBC – Competency Based Curriculum

EFA - Education for all

EYE – Early year education

KICD – Kenya Institute of Curriculum Development

NAEYC – National Association of Education of Young Children

NCST - National Council for Science and Technology

SPSS – Statistical Package for Social Science

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Instructional resources modeled to stimulate learner conceptualization of mathematical concepts tend to boost learning achievement during early years education. In cases where modeling of instructional resources are structured to build learning competencies in counting, learners in early years education develop abilities in basic mathematical concepts. Lee (2000) supports this view when he argues that the use of modeled resources improve learning achievement in arithmetic concepts such as counting and thereby boost manipulative skills of the learner. Lee (2000) notes that while logical steps are followed in modeling of resources, the learner tends to master mathematical concepts with ease, resulting in higher retention and subsequently better learning achievement. However, whenever modelling of instructional resources are inappropriately structured, conceptualization by the learner remains weak as arrangement of steps become illogical which in the end confuse learner thinking processes and most likely results into low learning achievement in acquisition of mathematical skills. Based on this realisation, the teacher's ability to model instructional resources targeting acquisition of skills in counting numbers may be lost because of structural deficiencies inherent in the development of requisite learning tools. Moreover, learning achievement in counting as a concept for building blocks in mathematical knowledge is most likely going to be lost since the learner does not have a grip on basic mathematics concepts. If this situation occurs, learning achievement is lowered because of low mastery and limited ability to utilise concepts in counting to solve immediate mathematical needs.

All learners in a given learning setup usually adapt to the situation and record growth. This is due to the structure of the human brain which can change in any given learning environment as the interaction between the brain and the resources takes place. Factors such as pedagogical skills, teaching approaches, teacher experience and teacher attitude towards modelled teaching resources together with the vigour during lesson presentation, location of the school, class enrolment, parent's social economic status, expectations and proper nutrition play an important role in the learning and achievement of counting numbers, (Kabiru & Njenga, 2007).

It has been demonstrated that modelled teaching resources serve an important purpose in the achievement of mathematical concepts in early year's education. Wasike (2006) opines that the principles and standards of understanding mathematics are set in early year education. The foundation of learning and understanding mathematics is therefore a matter of great importance. The use of modeled teaching resources during mathematical lessons in early year's education enable learners to actively construct mathematical understanding of their own (Smith, 2009). The instructional resources motivate early year learners into developing a positive attitude towards mathematics. Modelled teaching resources are physical objects that are used as teaching tools to enable the learners to have hands on experience of learning mathematics (National Association for the Education of young Children (NAEYC), 2009). Modeling of instructional resource especially in mathematical lesson presentation creates a middle ground between informal and formal mathematics in the early years education as they accelerate the process of building mathematical concepts into the intellectual faculties of the learner.

Kenyan curriculum recognizes early year's education as a starting point for advanced learning in science and technology. Mathematics being a vital subject in the learning of science and technology is a compulsory area of learning as it provides learners with concrete skills necessary for the development of the society (Republic of Kenya, 2005). Mathematics forms the backbone of all prestigious courses in science related fields such as engineering, architecture, medicine, design and agriculture. The teaching of mathematics therefore must be designed to address the immediate societal problems.

1.2 Statement of the problem

The acquisition of basic mathematical concepts in the early year education is a key concern among education stakeholders given that mathematics plays an important role in the building of any society. A strong foundation in mathematics ensures a strong attitude for science and technology and therefore methods of teaching mathematics in early year education should be modeled to address the societal challenges. Learners should be able to enjoy learning mathematics right from the early year education level. In order to achieve this, instructional resources should be modeled in order to aid in the building of mathematical concepts in early year education and subsequent intellectual development and mastery of mathematical concepts. They make learning enjoyable and effectively address leaner expectations in the learning of mathematical concepts. Modeled teaching resources help a learner to acquire high level mathematical understanding of concepts since they provide an avenue for the hands-on interaction and thus enhance mastery and understanding of mathematical concepts such as counting numbers.

Nevertheless, when modeled instructional resources are inappropriately structured, conceptualization by the learner remains weak since the arrangement of steps remain illogical and confuse leaner thinking process which result into low learning development. In addition, modeled teaching resources may have other features such as color and shape that slow the rate of learning during early year education since learners sometimes see them as playing items and not learning tools. Moreover, lack of modeled instructional materials in the mathematical lessons leads to lower conceptualization of mathematical skills. In other instances, teachers do not effectively model the instructional resources to address the learner needs and therefore learners misinterpret the meaning of the modeled teaching resources and end up confused. In effect, if modeled teaching resources are lacking or poorly structured during teaching and learning mathematics in the early year education, acquisition and retention of mathematical concepts are greatly hampered. The study seeks to determine the influence of modeled teaching resources on learner achievement in counting numbers in Mukuru Kayaba, Nairobi County, Kenya.

1.3 Purpose of the Study

The study sought to investigate the influence of modeled teaching resources on learner achievement in counting numbers in early year's education in Mukuru Kayaba, Nairobi county Kenya.

1.4 Objectives of the study

The study was guided by the following objectives:

i) Investigate the effect of the methodology used to motivate learners in counting numbers.

ii) To determine the influence of modeled teaching resources in learning arithmetic concepts.

iii) To establish the frequency in use of modeled teaching resources in learner achievement in counting numbers.

iv) To examine the influence of teacher attitude on modeled teaching resources in learner achievement in counting numbers.

v) Examine whether learners' performance in counting numbers improve when taught using modeled teaching resources.

1.5 Research Questions

The research questions in the study were:

i) What effect does the teaching methodology have in motivating learners in counting numbers

ii) How does the use of modeled teaching resources contribute to learner achievement in counting numbers?

iii) How does the frequency of using modeled teaching resources influence learner achievement in counting numbers?

iv) How does the teacher attitude towards modeled teaching resources influence learner achievement in counting numbers?

1.6 Significance of the Study

The findings will contribute to the knowledge on the importance of modeled teaching resources in learner acquisition of mathematical concepts in early year education development in Kenya and may be of immediate benefit to the county governments and the community. The study might also help the educational planners and curriculum developers in drafting policies that shape the planning and development of early year education. Moreover, the study might be resourceful information for the county governments' future plans in developing the early year education departments. It will also form a base on which other researchers can develop their studies.

1.7 Limitations of the Study

The study was limited to public early year education schools in Mukuru Kayaba ward since the method of data collection was time consuming and the researcher was only able to collect data in one early year education class per day. Collection of data using classroom observation form was time consuming and therefore the researcher limited the scope of the study to six public schools in Mukuru Kayaba only.

1.8 Delimitations of the Study

The study was delimited to public early year education schools in Mukuru Kayaba informal settlements in Makadara sub-county. The study was confined to preschool learners and respective teachers in sampled preschools. Data collection exercise was restricted to classroom environment only for early year learners and therefore did not capture learning

activities beyond the classroom. The study focused on the influence of modeled teaching resources on early year education level only and not the succeeding levels of learning where modeled teaching resources equally get used as teaching and learning tools.

1.9 Basic Assumptions of the Study

The study assumed that teachers understand the importance of modeled teaching resources in the process of learner's construction of their own knowledge and often use modeled teaching resources during teaching of mathematical concept of counting numbers. The study also assumed that all early year education classes in Makadara sub-county have different types of modeled teaching resources

1.10 Definition of Key Terms Used in the Study

The following operational definitions are adopted in the study:

Early Childhood Education – form of education given to the young children aged between 3-6 years. **Achievement** – how well a person, machine, etc. does a piece of work or activity.

Impact – have a strong effect on someone or something.

Number recognition - the ability to visualize, recognize and name number symbols.

Preschool – This is a learning institution of young children of age 3-6 years.

Early Year learners – There are children aged 3-6 years.

Counting – putting objects in a required order or sequence.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introductions

The chapter focuses on modeled teaching resources, relevance of modeled teaching resource, types of modeled teaching resources for learning mathematical concepts, influence of modeled teaching resources on leaner achievement in counting numbers, mathematical concepts in early year education, teacher attitude to modeled teaching resources, theoretical framework and the conceptual framework.

2.2 Modeled Teaching Resources

Modeled teaching resources introduce learners to a variety of words, symbols, models and images that represent similar concepts that are taught in mathematics such as counting numbers. In the process of constructing meaning learner gets empowered to use modeled learning tools frequently thereby acquiring necessary mathematical skills and concept such as counting numbers. A child in the early years of learning should be given opportunities to play freely with the resources before the lesson. This familiarizes them with the resources before they can be engaged in using them in class for concept acquisition purpose. If the learner is not allowed to play freely with the resources before using them as learning tools , he / she will develop a desire to concentrate on finding out other properties of the resource and thereby end up using it for play purposes. Charbonne (2013) support this view when he explains that the learners need to be familiar with the modeled teaching resource at hand so that familiarity may set in and thereby enable the learner to be at ease when using it for knowledge acquisition which leads the learner to experience intellectual growth. They argue that teaching resources may hinder high learner

achievement in mathematical concepts thereby interfering with the required progression to the next level of mastery of concepts. De Leach (2000) reveal that modeled teaching resources may not benefit the learners in gaining mathematical concepts when such materials have been used previously as play items in the class environment and are thereby meant to serve a symbolic function during mathematical activities during learning.

Further, the capacity of the teacher to model the instructional resources targeting development of reasoning skills for counting numbers may be hindered by lack of the requisite resources. In schools where these resources are lacking, learning achievement is greatly hampered as the learners cannot extend the concepts the teachers are drilling to the real world. By implication, intellectual reasoning and mastery of the basic mathematical concepts is not steady and sometimes lost. In addressing this, some teachers have found ways of improvising the free natural resources such as leaves and mud to reflect the concepts he/ she is teaching. In doing this, learners are able to interact and relate the materials to the concepts thereby building their intellectual faculties. Cramer & Henry (2013) opines that modeled teaching resources provide a modeling framework for the learners to experience improved intellectual growth and development in the acquisition of mathematical skills and concepts.

In a given ideal learning set up, a learner adapts to the situation and hence record intellectual growth which is brought about by the interactions taking place between the learner, environment and the modeled teaching resources. Based on this, the learner acquires the ability to record sustained intellectual growth and competencies to count and use the knowledge to address daily issues in life. The teacher competency in using structured instructional materials tends to influence learners' participation during learning

activities and acquire desired mathematical concepts. In addition, the modeled instructional resources assist the teacher to effectively and efficiently deliver content thereby enhancing leaner's achievement in counting numbers. in the same breadth, Smith (2009) observe that the use of modelled teaching resources during lessons of counting numbers in early year's education, learners are in a position to actively construct mathematical understanding of their own.

2.3 Modelled Teaching Resources as a Motivational Strategy

According to Piaget (1980), children have their own world perspective in which they must explore and interact with others in order to broaden their world perspective. They must be provided with a stimulating environment if they have to learn. Teachers use modeled instructional materials to make mathematics learning more real and tangible as they make connections to everyday life. According to the (World Bank, 1993), instructional materials are a key ingredient in learning. This is because the children's attention is captured with minds on and hands on. In essence this serves to motivate the mathematics learners.

According to Piaget (1980), children need to be actively involved in the learning activities for them to construct knowledge. They should be given the opportunities to explore, manipulate, experiment, observe and ask questions. In so doing, they acquire knowledge which contributes to their mental development. To help children construct knowledge and build schemas, they need to be provided with plenty of learning and play materials. Paget's constructivist theory implies that the teacher should be a facilitator of children learning. The teachers do this by providing an environment that stimulates children to construct knowledge and find out about things on their own as they play.

2.4 Relevance of Modelled Teaching Resources

Sutton & Krueger (2002) observe that modeled teaching resources greatly enhance the mental abilities of the learner at early year's education to create mathematical skills such as counting numbers. This is because modeled teaching resources capture the attention of learner through frequent interaction with the resources. According to Alfieri (2011), modeled teaching resources allow learners to interact with materials, manipulate variables, explore phenomena, and attempt to apply principles that afford them with opportunities to notice patterns, discover underlying causalities, and learn in ways that are seemingly more robust. As a result, they enhance the intellectual reasoning of the learner and subsequent mastery of mathematical concepts. Teachers should often use modeled teaching resources in their teaching of mathematical concepts since they make learning enjoyable for the learners.

Modeled teaching resources create an environment for learners to develop more interest in learning which improves the learning achievement in counting numbers. Ruzic and O'Connel, (2001) affirm that modeled teaching resources offer support to a leaner in acquisition of mathematical concepts thus able construct their own meaning during learning of mathematics. When the learner is fully aware of the many attributes of the modeled teaching resource, it becomes unlikely for it to be used as a mere presentational tool for learning in a given setting. Whereas teachers should ensure a variety of modeled teaching resources are available in class & enough for all learners, there are challenges facing the learning of mathematics in Kenya. According to Allen and Hart (1995), learning resources for use in early year's education should be chosen with an aim of giving the learner varied opportunities for practicing different skills and mastering intended concepts.

Cramer & Henry (2013) concur with this view and add that modeled teaching resources also provide a modeling framework for the learners to experience improved intellectual growth and development in the acquisition of mathematical skills and concept such as counting numbers.

Clement (1990) observe that touching of the modeled resources during lessons gives the early learners a chance to engage their senses in the learning process which makes the activity of learning mathematics quite interesting. In this way the teacher gets an opportunity to address the individual as well as the group need of the learners. The more skills a particular resource enhances prompts a child to make better use of it to acquire more knowledge. Children's character and behavior is that they want to see different things every time. Teachers who often apply different types of modeled teaching resources achieve more positive results compared to one who does not use resources in every lesson. Different types of resources increase the chance of greater perception, understanding and retention of knowledge as the color plays a vital role in catching the attention of the early learner. Olie (2007) also note that children at this level love bright primary colors such as red, blue and yellow. Welter (1999) also found out that the modeled teaching resources should be easy to handle for the learner during the leaning process without getting frustrated. Availability of teaching materials in mathematics learning provides a lot of hands –on experience to the learner and so all teachers should ensure the availability of plenty of varied learning resources for all learners in class at any given time. The acquisition of new concepts during leaning is usually linked to the interaction process that takes place between the learner, the environment and the resources since it contributes

highly to the adjustments that occur in the learners mental structures to accommodate the new knowledge

2.5 Types of Modeled Teaching Resource for Learning Mathematical Concepts

The main types of modelled teaching resource used in early years leaning are Flashcards, counters and models. Other modelled teaching resources are 3D models, graphic organizers, digital boards, charts, models, cuboids and pictures.

2.5.1 Flashcards

Silver (1981) describes flashcards as a database instruction procedure widely used for teaching mathematical concepts such as counting numbers. As a teaching resource, flashcards work and produce results by assisting in the burning of information in the brain of the leaner thus enabling the learner to make use of prior knowledge and apply it in the present process in order to construct meaning when actively engaging in mathematical activities during the learning process. Wendoh (2012) opines that flashcards provide hands-on experience to the learner during the learning process and thus contribute to high achievement in counting numbers. Gachuki (2012) also notes that flashcards teaches specific skills and concepts and therefore very useful in teaching counting of numbers. In the same breadth, Cramer and Henry (2013) points out that colourful flashcards help stimulate mental faculties of the learner by engaging all the senses during the learning activities thereby master the mathematical concepts with ease during the learning process. This greatly improves learner intellectual competency thereby able to count numbers. However when the teacher or the school fails to provide sufficient flashcards for learners during the learning process, learner achievement in counting numbers is greatly hampered leading to low mastery of mathematical concepts such as counting numbers. Flashcards

are vital teaching resources for early year education and should be availed to learners in every leaning session as it greatly enhances learner achievement in counting numbers.

2.5.2 Counters

Cramer and Henry (2013) defines counters as basic working touch that are variable in teaching and learning number work in the early years education to the different ways in which they can be put to use during teaching and learning of counting numbers. The early years education learners are concrete thinkers and therefore counters come in handy to enable them achieve enhanced performance in courting numbers. Swan (2007) opines that counters are available in all shapes and sizes making them popular among learners in the early year's education. Counters easily fit in the learners hands hence making them easy to move about during the learning process. They also are a great source of motivation to the learners as they engage all their senses during the process of counting numbers thus greatly enhance their intellectual development in counting numbers. Lee and Chen (2010) observe that the presence of counters in the learning environment of early year learner is of great importance as learners experience continuity of learning beyond the classroom situation leading to faster development of mental faculties which contribute highly to enhanced acquisition of mathematical concept such as counting of numbers. She further reveal that counters enable the learner to find solutions to their problems thereby discovering new systems and ideas as they are able to express their thoughts and contribute to enhanced approach to mastery of desired concept in counting numbers.

However, when counters are limited to classroom environment only, concept acquisition of mathematical skills such as counting is equally diminished. This is because the process of knowledge construction of the learner is not consistent thus promotes dependency on the teacher and inability to independently think on their own while counting numbers.

2.5.3 Models

Models tie together many ideas to explain a phenomenon or event. According to Joyce (2000), models are used to express ideas and promote creative thinking thereby contributing to enhanced learner achievement in mastery of concepts such as counting numbers. This makes models very useful in providing meaningful activity in the early year education as they also cater for the slow achievers in mathematical concepts acquisition. Joyce (2000) on her part defines a model that is used as a teaching resource to be a three dimensional object that is usually a simplified representation of a real object. This therefore makes models to include mainly number cut-outs, concrete devices, plastics and wooden number symbol, cuboid and kites as observed by Askew (1997). These resources contribute to the pleasure found by the learner during the learning process which assists the construction of desired knowledge leading to high learner achievement in the expected skill and concept such as counting numbers. Models are known to improve long term retention of knowledge in mathematical concepts and skills among learners. However, Mutunga (2004) opines that misuse of models in teaching of mathematical concepts and skills sometimes add qualities of the model which are not mathematical thus leading to misconceptions and confusions. An example of the use of a ball in teaching the concept of a circle will confuse learners to mistake the circle to be any circular region or a sphere which is not the case.

2.6 Modeled Teaching Resources and Learner Achievement in Counting Numbers

Flash cards work through burning information into the brains of the learner, Silver (1981). This means that as the learner engage in the leaning activities, they actively make use of the prior knowledge and apply it in the present setting to solve a given problem. When a learner practices a flashcard deck, the brain is given a clue on the front side and the attempt to actively recall the information on the back. Every time this process takes place the brain gets engaged to remember the learnt concepts thus makes flash cards a better resource for the process of memorization of counting numbers. Equally, flashcards also aid space repetition by helping in sorting learning events apart like counting numbers thereby spacing them and not massing them together.

Jason (2012) in his Psychology study in California University found that spacing using flashcards is a more effective study technique than cramming before an exam with 90% of participants performing better using this method. Flashcards activate the cognitive facilities of the learner, meaning that if a leaner believed certain aspect to be true and later gets surprised that the belief was incorrect, then the correct answer is remembered because it shocked the learner and become part of the memory thereby deepening the association to the concepts of counting numbers. This means correct answers arrived at when using flash cards during counting of numbers are encoded into knowledge in order for them to be retrieved when needed. Flashcards enhances retention to learn in chain reaction self-testing knowledge over a long time. Flashcards, especially image flash cards help learners to build comprehension skill during counting numbers. Gachuki (2012) in his study confirms that flashcards are effective and easy to use in elementary resource classroom and therefore are very suitable for early year learner and learners with learning disabilities. Van Hourten and

Rolider (1989) establishes that flashcards can be used in almost any learning environment as they teach specific skills such as counting numbers quickly and easily. Wilson (1991) also reveals that when students are taught using flashcards, they perform better and post higher scores than those taught without them. Flashcards therefore increase learner's fluency on basic mathematical concepts thereby enhancing learner achievement in counting numbers.

Lee and Chen (2010) notes that counters contribute to the successful internalization of mathematical concepts by the learner thereby demonstrating enhanced performance in mathematical concepts. Mecce (2008) finds counters to contribute to intrinsic motivation of the learner which in the end makes the learner to engage in the learning activity without necessarily being guided by the teacher. This process points at higher achievement in mathematical skills acquisition as the learner is able to formulate related activities and get solutions independently such as sorting and grouping numbers. Gilderdale (2007) also observes that counters present the learner with many chances of manipulation to enable the learner participate in the learning activity in many different exciting ways. National Association for the Education of Young Children (2000) study reveals that when counters are used to teach one to one correspondent or ordinary number, learner understands math processors and procedures easily and therefore recommend its use in elementary class setting.

Models are learning tools which assist the learner to solve problems discover or create new ideas or systems. Gilbert (2003) defines a model as a comparison of two things used to show similarity. Models therefore are learning tools that are used to express numbers and ideas thus promote creative thinking among young learners. For learners, models can be

number cut-outs, plastic or wooden number symbols, cuboids, kites and concrete devices. Models are also useful in providing meaningful activity for slower achievers in grasping of mathematical concepts as making them leads the teacher to a variety of regular classroom activities, thereby fully engage young learners and add pleasure as the teacher involves learners in making some on their own. However, model making can be time consuming and expensive thereby limiting their use in regular classroom environments.

In Hungary for instance, models are used in teaching early year learner as it serves an important purpose in acquiring mathematical ideas in a lesson. Jenni (2013) in her classroom observation discovers that dominors, cuisine rods and analogue clock faces were used as teaching resources in the introduction of numeral 6 to early year learners. As a result, the learning outcome is that children generalize the concept of six and can identify the numeral 6 from a group of number symbols. Her findings show that the experimental group that use the model to teach the mathematical concept perform better than the control group where the teacher uses only drawings and diagrams to teach the same concept. Suydam and Higgins (1976) equally confirm the same findings that models are effective in promoting learner achievement in acquisition of mathematical concept. Lesh (1999) suggests that models can be used effectively as an intermediate between the real world and the mathematics world like counting numbers in the early years education. This is because models usually inculcate the ability of problem-solving by providing a link through which children can imitate the real world situation of counting numbers to solving problems.

2.7 Mathematical Concepts in Early Year Learning

Children spend a lot of time doing activities which are related to number and number systems (Fiona, 2011). During the early years learning, a variety of number concepts are taught in a hierarchical sequence thereby making it difficult for the learner to understand and get involved in appropriately. Acquiring concept mainly rely on the sound understanding of ideas that have been learnt either through the curriculum or in the immediate environment; Fiona (2011). Steven (1999) reiterates that children believed they could count because they understood counting as just saying the number names in the right order. No doubt friends or relative do boast of children that can count numbers at a tender age of 3 years either in mother tongue or English. This confirms that children do learn quite a bit from their homes. Acquisition of mathematical concepts therefore should be promoted both in school and home environments. Early year learners are normally given assignments do to at home. This promotes learning at home as well.

The mathematical concepts for early year learner include identification of numbers, naming of numbers, matching numbers to their value and counting numbers. KICD for instance, provides a guide on how early year learner should be taught to master these mathematical concepts with the aid of structured instructional materials such as flashcards and counters. Field (2006) in his observation in the principles and standards of mathematics finds that the foundation for strong mathematical development is laid during the early years of learning. Modeled teaching resources play an important role in laying this foundation as the learner uses them to engage and construct meaning of the desired concept. Mathematical knowledge acquired in the early year education is hardly ever lost by the learner as it forms the basic point of reference in any given mathematical activity. Grasping

of higher order mathematical concepts therefore becomes easy for learners who acquire a strong foundation during the early years of knowledge acquisition in desired skills such as counting, (Treacy, 2012). Therefore, acquisition of mathematical concepts is an important focus of learning in early year education. Governments for that matter have incorporated these basic learning concepts in curriculum that lay a strong foundation for knowledge development. Kenya for instance, has revised its curriculum design with a view of promoting competency based learning approach instead of performance based learning approach.

2.8 Teacher Attitude in Modeled Teaching Resources

The attitude of the teacher toward the use of modeled teaching resources play an important role in teaching learning process in an early year education classroom. Howden (1986) observes that most lessons where manipulative teaching resources are used do get noisy as the learners engage in learning activities. Moreover, the classroom size of most public schools is usually high with children aged 3 to 6 enrolled in the same class. This makes the class disorganized and hampers teacher's judgment on the achievement of the intended objectives of the lesson. Instances of lack of class control can easily arise before the end of the lesson as the materials get shared by the learners thus lead to destruction of the teaching resources. Therefore, It is important for the teacher to feel at ease with the teaching resource in order to be able to present it to the learner successfully in the process of constructing meaning during learning. Burn (1992) notes that very few teachers do attend training on using modeled teaching resources thus majority do avoid using the modeled teaching resources since they aren't very competent in using them in accomplishing mathematical tasks adequately. Burn (1975) opines that inadequate storage

facilities for the teaching resource in also an issue of concern that frustrate many early year education teachers. Teachers who have put efforts in making the resource usually get demoralized when they see the resources getting destroyed or stolen. Early year education learners are naturally playful and often mistake modeled teaching resources for play toys. First time teachers normally find it difficult to control the class as learners become too concerned with playing with the items instead of learning the new concepts.

2.9 Theoretical Framework

This study is based on the constructivist theory which suggests that humans construct knowledge and meaning from own experience. The constructivist view of learning argues that learners actively construct their own knowledge when teachers act as a facilitator and not the main source of knowledge. Learners discover and transform information and check new information against old. Constructivist conceptions of learning have their historical roots in the work of Dewey (1929), Bruner (1961), Vygotsky (1962), and Piaget (1952). Piaget (1952) emphasizes that learning outcomes should focus on the knowledge construction process and that learning goals should be determined from authentic tasks with specific objectives. Constructivism is an approach to teaching and learning based on the premise that cognition (learning) is the result of "mental construction", where learners learn by fitting new information together with what they already know. Constructivists believe that learning is affected by the context in which an idea is taught as well as by students' beliefs and attitudes. Piaget's theory of Constructivist learning has had wide ranging impact on learning theories and teaching methods in education and is an underlying theme of many education reform movements.

Early year learners constantly try to derive their own personal mental model of the real world from their perceptions of that world. As they perceive each new experience, they continually update their own mental models to reflect the new information, and therefore construct own interpretation of reality. Jonassen (1994) on the other hand, argue that constructivism is often misconstrued as a learning theory that compels students to "reinvent the wheel." In fact, constructivism taps into and triggers the student's innate curiosity about the world and how things work. Learners do not reinvent the wheel but, rather, attempt to understand how it turns and how it functions. Learner constructs knowledge by relating and exploring with real objects like models and flashcards thereby making meaning about the mathematical concepts. The objects help a learner to move from a concrete to an abstract level of understanding since they see, touch and interact with them and thus develop a clearer mental image that represent the abstract idea more completely. The objects also trigger their mental models to reflect new knowledge. The learning environment therefore must take into account the space, infrastructure and learning resource that is used by the learners during the lesson. Children whose mathematical learning is firmly grounded in the model experiences will be more likely to bridge the gap between the world in which they live and the abstract world of mathematics (Dienes, 1960). Land & Hannafin (2006) argue that “the interlacing of content, context and understanding, the individual negotiation of meaning, and the construction of knowledge are promoted in a learning environment that promote constructivism”.

2.10 Conceptual Framework

The interaction between the variables is present in this conceptual framework. The variables in this study are the independent, dependent and extraneous variables. The process involves the interaction of the resources and their contribution to early years learners achievement in counting numbers. Mathematics activities are facilitated by the teaching resources and the interactions in the learning process for learner's to construct their own mathematical knowledge. The study is guided by the following conceptual framework showing how various variables interact with each other:

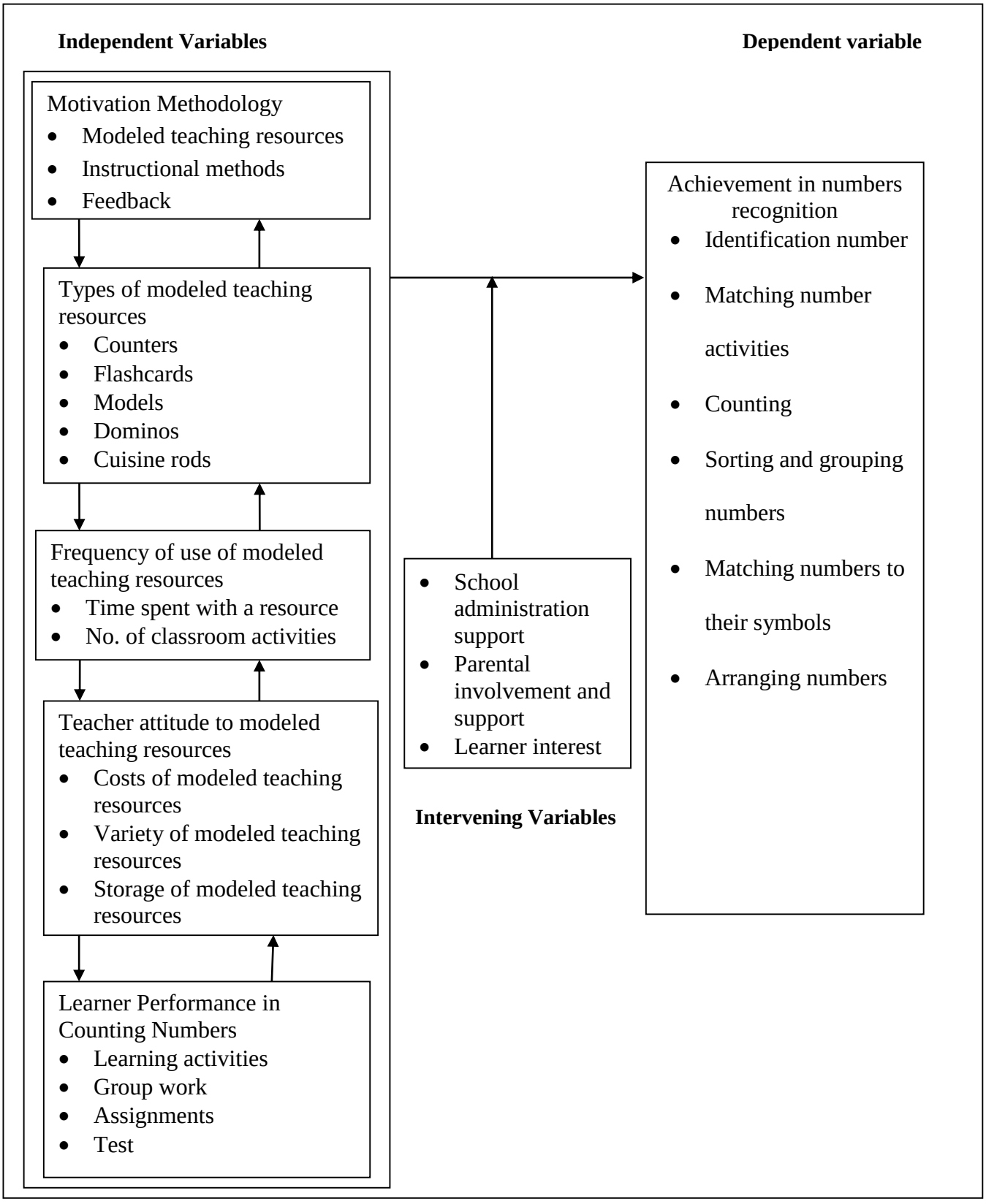

Figure 1: Conceptual framework of Modeled Teaching Resources

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter focuses on research design, target population, sampling procedure and sample size, data sources, research instruments, reliability, validity, pilot survey, data collection procedures and data analysis.

3.2 Research Design

This study employed a descriptive survey design. Orodho (2003) defines descriptive research design as a technique in which detailed information concerning a phenomenon is gathered by posing questions to respondents. The research entails gathering of facts and information about the influence of modeled teaching resources through a survey in which teachers and learners are interviewed in order to get opinions regarding the influence of teaching resources. Both quantitative and qualitative data was gathered to portray the true impact of the teaching resources. Mugenda and Mugenda (1999) defines survey as an attempt to collect data from members of a population in order to determine correct status of that population with respect to one or more variables. The study design availed useful information about the effect of modeled instructional resources on learner achievement with regard to counting numbers.

3.3 Target Population

The target population was all the public early year education school in Mukuru Kayaba informal settlement in Makadara sub-county. The study involved all public pre-school teachers and learners in Mukuru Kayaba informal settlements. According to statistics, there are 6 public pre-schools attached to public primary schools in Mukuru Kayaba informal

settlements with a total of 383 early year education learners. Table 1 indicates the distribution of preschools in the sub-county.

Table 1: Population Distribution

School Code	No. of EYE classrooms	No. of EYE learners	No. of EYE teachers
NAMA-SC 001	2	64	2
NAMA-SC 002	4	54	4
NAMA-SC 003	3	90	3
NAMA-SC 004	2	60	2
NAMA-SC 005	2	48	2
NAMA-SC 006	2	67	2
Total	**15**	**383**	**15**

Orodho (2016) defines a target population as a set of elements that the researcher focuses upon. Mukuru Kayaba Informal settlement was chosen to be the target population for the study because of socio-economic factors related to the area. The Informal settlement is one of the cluster Informal settlements found in Mukuru and is located in Viwanda ward, Makadara sub-county in Nairobi County. Many households live in tiny iron sheet houses and the children do not have access to resource centers or other public educational sites except the public schools and therefore, modeled teaching resources are of great importance for their intellectual development. In this regard, preschool learners and teachers were selected to participate in the study.

3.4 Sampling Procedure and Sampling Size

The study applied a combination of systematic and simple random sampling techniques to draw a sample of three (3) public early year education schools and three early year education classes to represent the influence of modeled resources in learner achievement in Mukuru Kayaba informal settlement. According to Orodho (2016), Sampling is a

process of selecting a sub-set of cases in order to draw conclusions about the entire population. Systematic sampling is the selection of elements at equal intervals, starting with a randomly selected element on the population list. The sampling is common in educational and social science research where large populations are studied based on alphabetical order of the members that are available. In Mukuru Kayaba, the public schools are all under the Ministry of education and their levels of management are uniform hence systematic sampling was the ideal sampling technique for selecting the school to be sampled. The study chose to visit three schools among the six because of time and financial constraints. In order to select three schools, a sample constant was calculated as below

Sample constant, $K = 6 / 3 = 2$

Therefore, every 2^{nd} school from the list presented below was selected for the study. Similarly, simple random sampling was used to select the early year education class to be sampled since the schools had more than one early year education classrooms. This is because each class had an equal independent chance of being selected as a member of the sample. The study noted that all the early year education classrooms in the schools had an equal chance of selection and therefore selecting one class randomly would be unbiased and non-discriminative in any form and results obtained would be reliable. The researcher used convenient sampling to select eight boys and eight girls from each sampled classroom. The researcher asked the learners to volunteer for the tests in order to saved time. The researcher selected a total of 48 learners who undertook the oral tests in groups of four learners. This met the requirement of 10% and above of the total population (Mugenda and Mugenda, 2003). From the list below, the schools with the following codes were selected

for the study; NAMA-SC 002, NAMA-SC 004 and NAMA-SC 006. The schools were coded for ethical reasons as shown in table 2.

Table 2: Summary of the sampling frame

Name of School	No. of EYE learner per class	No of groups of learners in each class	No. of learners selected	No. of EYE teachers
NAMA-SC 002	27	4	16	4
NAMA-SC 004	34	4	16	2
NAMA-SC 006	30	4	16	2
Total	**91**	**12**	**48**	**8**

Similarly, all the 8 teachers from the selected schools were chosen to participate in the study. This is because teachers have an overall opinion of the modeled teaching resources and therefore their participation in the study is critical. In total, the researcher selected 56 participants comprising of 8 teachers and 48 early year learners to participate in the study.

3.5 Research Instrument

The study used the following instruments: classroom observation schedule, interview guide for teachers and pre-test and post tests for early year education learners, to collect data regarding the influence of modeled teaching resources in learner achievement. An oral performance test (pre-test and post-tests) was conducted on a group of early year education learners, comprising of two boys and two girls, to determine their numerical reasoning before and after a mathematical lesson where modeled teaching resources were used and their performance scores recorded. The mathematical concepts tested were number identification, number sorting and number counting.

Similarly, an observation form was used to record how teachers and learners interacted with the modeled teaching resources during mathematical lesson. The researcher identified four main thematic areas that would be observed during class lesson time. The four areas of study interest on MTR influence were introduction phase, lesson development phase, lesson assessment phase and lesson conclusion phase.

The interview schedule was standardized to ensure the set of questions was asked in the same manner to different respondents to minimize biasness. Early year education teachers were asked questions regarding their world outlook on modeled teaching resources and how they influenced their lesson preparation and execution.

3.6 Reliability

Reliability is the extent to which a research instrument produces the same results on repeated trials. A measuring instrument is reliable if it provides consistent results over a period of time. The study sought to establish whether the instrument could be administered to the same respondents and produce similar scores. A test-retest technique was used to estimate the degree to which the same results were obtained with a repeated measure of accuracy. This was done by administering the instruments to samples for a pilot survey and then data was collected. After a time lapse of one week, the same instruments were administered to the same group of respondents. The results of the initial responses were then correlated with the latter to compute the coefficient of stability. The results produced a correlation coefficient of 0.918 which was closer to 1, making the instrument reliable.

3.7 Validity

Validity refers to the degree to which the instrument fully assesses or measures the construct of interest (Orodho, 2016). To enhance content validity, the research instrument was appraised by my project supervisors who are experts in early childhood education. Their contributions and suggestions were used to review and clarify ambiguity. They guided the study to ensure that the items in the instruments were representative, relevant and addressed all the study objectives.

3.8 Pilot Study

Nachmias and Nachmias (1996) observes that pilot testing reveals fake questions and unclear instructions. The purpose of the pilot study was to pre-test the research instrument in order to validate it and ascertain its reliability. Through the pilot study, major problems and instrument deficiencies were identified and improvements made. The appropriateness of the language was also checked. A test re-test technique was applied using a convenient sample of 2 teachers and 2 groups of 4 EYE learners each from the school with the code NAMA-SC 004l. The test revealed blank spaces, inaccurate sentences and inconsistencies in the study tool, then the results were analyzed and corrections with appropriate amendments made.

3.9 Data Collection Procedure

The researcher paid a courtesy visit to the sampled early year education schools prior to actual collection of data. She familiarized herself with the school environment and sought consent from the respective administrations and early year education teachers. She also explained to the intended respondents what the study was about and how it would benefit her studies. Suitable dates and days were scheduled that allowed respective early year

education teacher to organize and prepare the early year education classes adequately. For pre-test and post-tests, the researcher visited the schools on different days. On the first day, the researcher conducted oral tests on four groups of early year education learners in each class before the lesson. For the post-tests, the researcher conducted the same tests on the same groups of early year education learners after a lesson on number concept using modeled teaching resources. The researcher personally visited the respondents for the interview and classroom observations which were done face to face to avoid any malice. This also maximized the truth of the responses received as well as assuring respondents that their responses would be treated with confidence.

3.10 Data Analysis Procedures

Quantitative data was coded then cleaned before entry into Statistical Package for Social Science (SPSS) for validation and analysis. Appropriate descriptive analysis produced frequency distribution and percentages while charts and tables were produced using Ms-Excel. Scores of respondents in each item was pooled to give overall mean score and then converted to percentages for clearer interpretation. Data was analyzed using descriptive statistics to assess the influence of modeled teaching resources on learner achievement in counting numbers in early year education.

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

3.11 Ethical Considerations

The researcher explained to the respondents the purpose of the study and its benefits, and got their consent of participation into the study. Similarly, the information gathered was treated with confidentiality and no personal information was collected in order to maintain anonymity of the respondents. The selected schools were coded in order to hide the identity of the respondents. In order to build a rapport with the early year teachers, the head teachers introduced the researcher to the respective teachers. During the classroom observation exercise, the researcher was introduced to the learners by the respective teachers in order to boost confidence and erase doubt about the identity of the researcher.

CHAPTER FOUR

FINDINGS AND DISCUSSIONS

4.1 Introduction

This chapter focuses on instruments return rate, demographic information of early year education teachers, Influence of modeled teaching resources on learner achievement, modeled teaching resources usage frequency on learner achievement, teacher attitude on modeled teaching resources in learner achievement and results on intelligent tests. The objectives of the study were as follows: to determine the influence of modeled teaching resources on learner achievement in counting numbers, to establish the frequency of use of modeled teaching resources on learner achievement in counting numbers, to examine the influence of teacher attitude on modeled teaching resources in learner achievement in counting numbers and to determine learner performance in counting numbers using modeled teaching resources. The analysis will be done as per each objective.

4.2 Instruments Return Rate

The study targeted 48 early year education learners, 8 early year education teachers and 3 public early year education schools in Mukuru Kayaba. All the respondents were administered the study tools in form of structured interviews and intelligent tests. The study thus sought to establish the instruments return rate and results shown in table 3.

Table 3: Return Rate

Respondent type	Number Sampled to participate	Number Participated in the study	Return rate
EYE Schools	3	3	100%
EYE Teachers	8	7	87%
EYE Learners	48	48	100%
Total	**59**	**58**	**98%**

The results in table 3 indicate that the return rate of 100% was realized among early year education schools and early year education learners while a return rate of 87% was realized in early year education teachers. The overall return rate is 98% and is adequate for the analysis of the study as Mugenda and Mugenda (2003) recommends that a return rate of more than 50% is adequate to analyze the finding of the study. The success was attributed to administrative and coordination support provided by the various early year education teachers in the selected schools.

4.3 Background Information of the Respondents

The study assessed the background information of early year education teachers in terms of gender, teaching experience, age group and highest academic qualifications as shown in table 2.

Table 4: Demographic Information of Early Year Education Teachers

		Frequency (n)	Percentage (%)
Gender	Male	1	14
	Female	6	86
Teaching Experience	1 to 5 years	2	29
	6 to 10 years	5	71
Age group	20 to 30 years	2	29
	31 to 40 years	1	14
	41 years and above	4	57
Highest academic qualification	Certificate	4	57
	Diploma	2	29
	Bachelors	1	14

The results in table 4 show that the highest percentage of early year education teachers in Mukuru Kayaba are females at 86% (n= 7) while the males account for 14% (n=1). This revealed that female teachers were more likely to be found in early year education schools

in Mukuru Kayaba than male teachers. On the teaching experience of early year education teachers, the study show that 5 (71%) teachers had taught early year education classes for over 6 years while 2 (29%) had taught for less than 5 years. This show that majority of early year education teachers teaching in Mukuru Kayaba early year education schools are experienced in teaching and therefore are in a position to confirm or dismiss the influence of modeled teaching resources. This also proves that many public schools in Mukuru Kayaba have well experienced early year education teachers capable of assessing the learner achievement accurately. Furthermore, the teachers are able to create the right environment for early year education learners to learn and master basic mathematical concepts such as counting numbers.

With regard to age group of early year education teachers of public schools in Mukuru Kayaba, the findings reveal that four out of the seven teachers interviewed are aged 41 years, constituting to about 57% shown in table 4 above. On the same note, early year education teachers aged below 30 years accounts for 29% (n= 2) while those aged between 31 to 40 years were 14% (n=1). The study reveals that most early year education teachers get posted to their current stations when they are in their mid years. This is attributed to the county government policy of hiring experienced teachers to manage the early year education schools. In relation to academic qualifications of early year education teachers, the study findings indicate that the majority 57% (n=4) teachers have certificate in Early Childhood Education while 2 (29%) have diploma in Early Childhood Education. Equally, 1 (14%) teacher has a Bachelor's degree in Early Childhood Education. The findings revealed that the entry qualification for teaching early year education class is a relevant certificate from a recognized institution. This was in accordance with the education

regulations of hiring well trained and experienced early year education teachers. The teachers who had attained diplomas and bachelors degree admitted to have been hired on a certificate qualification and over time improved on their academic qualification.

Some of the teachers interviewed with certificate training admitted that they needed more training so as to confront the increasing challenges arising with the advancing world in information technology. Most teachers had basic IT training and therefore could adapt better to the technological aspects that were taking root in the education ministry. Early year education teachers proposed continuous professional development program in their careers to enable them become more nourished with knowledge regarding early year education. With the changes in the curriculum from performance based to competency based, teachers felt additional training was inevitable in their careers as they would understand and comprehend better the requirements of the new curriculum.

With regard to early year education class composition, the study focuses on three (3) different early year education classrooms drawn from three sampled schools in Mukuru Kayaba. Table 4 presents the frequency distribution of the three early year education classes in terms of size and gender. The findings show that the minimum class size is 26 learners while the maximum is 45. The average number of boys and girls per class is 17, while the average class size is 34 learners. The frequency distribution table of the classes is shown in table 5.

Table 5: Frequency Distribution Table of Classes

School code	No. of Boys (n)	No. of Girls (n)	Total (n)
NAMA-SC 002	18	14	32
NAMA-SC 004	21	24	45
NAMA-SC 006	12	14	26
Minimum	12	14	26
Maximum	21	24	45
Mean	17	17.3	34.3

The findings in table 5 indicate that the schools in Mukuru Kayaba have a well balanced population of boys and girls in early year education. Equally, the findings indicate that the majority of the early year education classes surveyed have manageable class size except for one class that has over 45 learners. The teachers' managing the early year education classes said that strict enrollment of learners within the acceptable age group of between 5 and 6 years for PP2 class is the main factor to having manageable size of class since it's a factor in learner achievement and teachers are comfortable teaching classes of less than 30 learners.

4.4 Effect of the Methodology Used to Motivate Learners in Counting Numbers

Objective one sought to investigate the methods teachers use to motivate early year education learners when introducing mathematical concepts such as counting numbers. The instrument that was used to capture this objective was the observation form and the findings are shown in table 6.

Table 6: Methods Teachers Use to Motivate Learners

	Effect	Effective		Very Effective	
		N	%	N	%
Lesson Introduction – *Song, poem, dance,*	Relevance	2	67	1	33
	Arouse Interest	2	67	1	33
	Positive atmosphere	1	33	2	67
	Hands-on engagement	1	33	2	67

The findings in table 6 show that early year education teachers introduce their lessons with relevant songs relating to number work. In the three classes observed, the song was effective in 2 (67%) classes and very effective in one class (33%). The songs are essential in motivating and creating an environment for the learners to develop more interest in learning thus improve learning achievement in counting numbers as noted by Sutton et al (2012). Similarly, only one class had over 90% of the learners actively singing the song as the teacher displayed the different flashcards that represent the concepts in the song. This proves that the songs stimulate learners into participating into classroom activities and thus understand better the concept of counting numbers. In the two classes, more than half the learners were active participants in the song. This shows that songs introduce modeled teaching resources in a more friendly way since it creates positive environment for learning as well as capturing the attention of the learner in teaching- learning process. Sutton (2012) affirm this view by saying that modeled teaching resources create an enabling environment for learning as it captures the attention of the learner thereby enhancing their concentration to classroom activities.

According to the observations, 2 (67%) classes showed that modeled teaching resources are effective in arousing learner interest. Moreover, two (67%) classes proved that modeled teaching resources are also responsible for creating positive learning environment where teachers and learners explore new knowledge. The results in table 4 show that modeled teaching resources when blended in the songs have a significant effect in creating positive classroom environment. In one of the classes surveyed, there were several types of brightly colored modeled teaching resources which had massive impact on learner engagement and achievement. Learner's attention is greatly captured by the colors of the modeled teaching resources and even the teachers agree that learners are more engaged in class if they are provided with plenty of different types of colored modeled teaching resources.

One teacher said the following "learners touch and play with them thus interactive", indicating they motivate learners to engage in class. This reveals that modeled teaching resources are more effective if provided in plenty and in different shapes and colors. In the observations, early year education teachers gave different flashcards presenting numbers 1 to 9 to about 9 randomly selected learners. In every step of the song, the learner whose number had been mentioned in the song would step forward and dance as others sang along. This proves that modeled teaching resources are essential in building number identification concept to learners. The song, "I am number one…." was observed to be the most common song in all the early year education classes visited. The early year education teachers said that they loved the song because it introduced the concepts of mathematics very well as it specifically touched on number identification. Learners who were not sure or who had learning difficulties got engaged to know the number that their fellow learners were holding

in their hands and sometimes they would scramble for attention so as to be picked to carry the flashcard so they could dance.

With regard to learners with learning difficulties, modeled instructional resources are effective in capturing their attention as well even though some teachers believe their challenges are mostly family-related and they cannot match the pace of other learners. One teacher said the following “some of these pupils come from very poor households and are therefore disturbed mentally by the goings on their places”. The statement shows that some teachers profile the learners based on their family’s economic status and are therefore not keen to address some of the challenges that are hindering intellectual development in the learners. Moreover, class size is a factor in determining teacher attitude to learners with learning difficulties. The teacher with over 40 learners in her class explained that it was difficult to attend to every need of the learner since she had limited time to present her concept. It was also a challenge to notice if all the learners were singing the song as the study observed that some learners were murmuring instead of singing. It therefore shows that teachers are mostly in control of smaller classes than larger ones.

In order to counter some of the challenges highlighted, early year education teachers prefer that they have a library of diverse instructional tools for use in classroom lessons. They believe that if every learner is provided with a flashcard or a model during the song, then they would have very little challenge in having the attention of all learners in the class. This shows that many early year education teachers in Mukuru Kayaba do not have enough modeled teaching resources for teaching mathematical concepts. They emphasize that unlimited access to modeled teaching resources by the learners during lesson time is a big factor in the learner achievement of mathematical concepts such as counting numbers.

4.5 Influence of Modeled Teaching Resources in Learner Achievement in Counting Numbers during Lesson Development Phase

The study observed that early year education learners engage with the modeled teaching resources as the teachers provided instructional support. Teachers admit that modeled teaching resources have made learning interesting for learners and thus spend little time drilling the concept to learners. Sutton and Knieger (2012) opines that modeled teaching resources greatly enhance the mental abilities of the learner at early year's education and therefore could adapt mathematical skills such as counting numbers faster. Sutton and Knieger (2012) emphasizes that modeled teaching resources create an environment for learners to develop more interest in learning which improved the learning achievement in counting numbers. The findings of the impact of modeled resources in lesson development are presented in table 7.

Table 7: Effectiveness of Modeled Teaching Resources in Lesson Development

		Effective		**Very Effective**	
		N	%	N	%
Lesson Development – *Interactions with the Modeled teaching resources*	Learner participation			3	100
	Individual / group activities	1	33	2	67
	Concept development			3	100
	Effective learning	1	33	2	67
	Learner confidence			3	100
	Positive learning environment			3	100

The findings in table 7 show that all the classes observed (3, 100%), modeled teaching resources are very effective in enhancing learner participation throughout the lesson development session. In instances where learners have plenty of modeled teaching resources to interact with, continuous engagement with teachers is witnessed. Similarly,

modeled teaching resources are very effective in developing the different mathematical concepts as seen in the 3 (100%) classes. For instance, in developing the concept of number recognition, learners would hold the model that represented different numbers and read out aloud. This indicates that they are able to recognize the numbers that is written on the models. The findings further reveal that modeled teaching resources arouse learner's curiosity and therefore ask questions more regularly thereby making the lesson interesting and enjoyable.

In cases where the teacher fails to provide enough resources, modeled teaching resources are not effective in aiding individual / group activities because there are few tools and therefore learners scramble for them. This disrupts the smooth classroom activities and hinders the teacher from delivering the concepts. The finding shows that access to plenty of modeled teaching resources is a big factor in influencing learner achievement. The study also show that models and counters are the most common types of modeled teaching resources used, as observed in 3 (100%) of the classes while pictures were the least common as observed in only one class. The teachers said counters come in different shapes and sizes therefore can easily fit into the early year education learner's hands. This enhances confidence and mastery of concepts taught easily as the learner is able to interact easily with the resource. This observation is supported by Swan (2007) who notes that counters are available in all shapes and sizes making them popular among learners in the early year's education. Similarly, counters easily fit in the learners' hands hence making them easy to move about during the learning process. One teacher said the following "brightly colored counters are very popular with my students since they not only present the number concept, but also the materials they are made of are a big curiosity to the

learner". The statement proves models could be used for several things as they provoke the learner to know more about the object. For this and other similar reasons, teachers overwhelmingly approved of modeled teaching resources to be the best teaching tools in early year education classroom setup.

The study equally shows that modeled resources compel the learners to engage their teachers and discuss outcomes of the concepts they are learning. They also engage a lot with their peers and discuss the concepts generated among them. Ruzic and O'Connel, (2001) observe that modeled teaching resources offer support in acquisition of mathematical concepts thus enable learner to construct own meaning during the learning of mathematics. Similarly, Allen and Hart (1995) observes that provision of learning resources for use in early year education should be chosen with the aim of giving the learner a wide range of opportunities for practicing different skills and mastering intended concepts and therefore teachers ought to provide many different kinds of modeled teaching resources for learners to engage with and share with the peers.

According to the teacher's interview, "Modeled teaching resources assist learners understand mathematics easily and makes linking to digital literacy easy such as projector", indicating that abstract modeled instructional materials assist learners in understanding other digital learning tools. Another teacher echoed the same by explaining the following "Modeled teaching resources make learning easy as it assists early year education learners to relate the numbers and concepts quickly thus lesson becomes easy to teach and learners enjoy the process", proving that the modeled resources help in breaking down the concepts for easy understanding by the EYE learners.

The statements further show that modeled teaching resources is essential in teaching and learning of mathematical concepts such as counting numbers. Some teachers said they could not teach in early year education classes without the modeled teaching resources as they not only made learning interesting but also motivate the learners. One teacher said the following "Modeled teaching resources motivate learners to participate in the learning process", an indication that they stimulate learners into engaging in classroom learning process. This makes learning interesting as teachers and learners engage into understanding the concepts clearly. This makes modeled teaching resources very useful in the development of the lesson.

Elaborating further on the influence of modeled teaching resources in learner achievement in mathematical concepts, the researcher observed that modeled teaching resources are particularly vital in sorting numbers, pairing numbers and counting numbers. On observation of the application of modeled teaching resources in sorting numbers, early year education teachers would pick a dozen models or flashcards and ask the learners to arrange in order of value, beginning from the smallest to the largest. In the seven classes observed, about 80% of learners were able to correctly sort the flashcards in the correct manner. In one particular class, the teacher knowingly left out number 7 and asked the learners to sort accordingly. About 3 learners could not notice there was a missing number while some got stuck in the middle. This proves that most learners need to continually recite the numbers even after the classroom setup as some forget the concepts very fast. The study proves that learning process of early year education learner need a continuous process that begins in class and continues even at home and therefore the learners need to have modeled teaching resources at home as well. One teacher had this to say "Mathematical concepts are basic

life concepts that should not only be taught in class, but by every person that the learner interacts with." This shows that teachers feel parents are not doing enough in building the basic mathematical concepts of the learner since mathematical concepts are applicable in almost every instance in life.

On the observation of group work activities in solving the problem of matching number to their value, one teacher arranged learners in different groups of three to eight persons per group. She then asked the learners to pick flashcards from a pack that represented the number they were in a group. All the groups got it right as the group with three learners picked a flashcard with number 3 written on it and so forth. To achieve this, learners were seen discussing amongst themselves on how many they were before picking the number representative of the group size. The findings show that modeled teaching resources are essential in building the concept of matching number to the value. Modeled Teaching Resources are also seen to influence social skills of the leaner as they have to brainstorm and discuss amongst themselves.

On the concept of counting numbers, learners were given flashcards and models in groups to count one by one and in order. Some teachers arranged learners in groups of 10 each while some simply gave out the models to individual learners to count. Each learner was required to say aloud the number he/she was holding and would then be appreciated by other learners for saying the correct number. This motivated other learners to say the correct number of the models represented. One teacher gave learners an assessment of counting the number of shoes their fathers had at home. The teacher's intention was to relate the mathematical concepts taught in class to things found at home. The learners found this assignment to be very interesting as they would tell the number of shoes their fathers

had at home even before leaving for home. Some learners said their fathers had seven big fat shoes, while some said they had seen their fathers with black shoes only, without stating how many. This made the learning process very interesting and interactive.

4.5.1 Influence of MTRs in Lesson Assessment and Lesson Conclusion

The study observes that modeled teaching resources are applied in the assessment and conclusion of mathematical lessons. This is an important step in ensuring learners record significant intellectual growth from the given learning set up where learners and teachers interact with modeled teaching resources with an objective of building mathematical concepts. Teachers normally administer oral tests by displaying the modeled instructional resources that represented a certain number then ask the learners to name the number in groups or as an individual. The results of the effectiveness of modeled instructional resources are shown in table 8.

Table 8: Effectiveness of Modeled Teaching Resources in Lesson Evaluation and Conclusion

		Effective		Very Effective	
		N	%	N	%
Lesson Assessment and Conclusion	Concept mastery	1	33	2	67
	Teachers questioning			3	100
	Feedback			3	100
	Peer learning	1	33	2	67

The findings in table 8 reveal that modeled teaching resources are very effective in assessing learner's achievement in mastering concepts as witnessed in two (N=2, 67%) out of the three classes observed. They are very effective in aiding teachers in questioning (N=3, 100%) learners on what they have been taught. Similarly, modeled teaching resources are very effective in providing feedback (N=3, 100%) as witnessed in all the

three classes and assist greatly in peer learning as observed in 2 classes (N=2, 67%). The early year education teachers gave learners the items to count individually as others observed. The learners who got the counting correctly were appreciated while those who did not were referred to their friends for help. In one class, the teacher though did not guide early year education learners with learning difficulties citing time constraints while in the remaining classes, teachers were instrumental in guiding learners with learning difficulties since it was easy for learner to relate the concept being developed with things at home. Further, the findings revealed that the teachers did write homework on cards for the kids to work on after school as the learners find the resources very interesting.

From the observation, it is evident that most learners acquire intellectual growth and competencies to count numbers faster with the aid of modeled teaching resources. For some however, the process is slow and they fail to count properly. This is attributed to various reasons such as lack of confidence by the learner who confuses the tools for toys and therefore gets bemused as to what the model presents. In order to address this confusion, teachers refer learners who are struggling to the competent ones for guidance. One teacher said the following "Modeled teaching resources becomes interesting to both teacher and learner as the learner is actively involved in using their senses to construct knowledge for themselves, not forceful learning" , indicating the resources make assessment of learners easier.

4.6 Frequency in Use of Modeled Teaching Resources in Learner Achievement in Counting Numbers

Objective three sought to establish how frequent teachers use modeled teaching resources in the teaching mathematical concepts. The instrument that was used to capture this objective was the teacher interview guide. The findings reveal that early year education teachers find modeled teaching resources to be important items for teaching mathematical concepts. One teacher in particular said the following "I cannot teach in this class without them". This statement further highlights the importance of modeled teaching resources in the acquisition of mathematical concepts. On being asked how often they used modeled instructional resources in their lessons, all the teachers interviewed acknowledged they always used the modeled teaching resources in the mathematical lessons not only to teach the concept of counting numbers, but also other concepts of mathematics such as sorting, pairing and grouping numbers.

4.6.1 Frequency of Modeled Teaching Resources in Lesson Introduction

The study sought to determine how frequent modeled teaching resources are being used in lesson introduction phase. Teachers were asked how many times they used modeled teaching resources in the lesson introduction stage and they said the following;

- "Modeled teaching resources speed up process of learning and therefore I introduce them right at the beginning of the lesson"
- "Modeled teaching resources arouse leaner interest and curiosity thereby enjoying the lesson"
- "Modeled teaching resources make learners alert and active therefore I introduce them every time I begin my class"

The findings reveal that the teachers introduce modeled teaching resources in the introduction stage to capture the attention of the learner. Modeled teaching resources also make learners more attentive in class and therefore become important when introduced at the lesson introduction phase. Similarly, one teacher noted modeled teaching resources made her learners develop a positive attitude for the lesson at the beginning of the lesson and thus she frequently introduced modeled teaching resources at the lesson introduction stage.

The researcher also observed that in all of the three classes visited, the teachers introduced modeled teaching resources at the lesson introduction stage and frequently displayed the tools to the learners to motivate them. The teachers believed concept acquisition began at the lesson introduction stage and therefore introducing the modeled teaching resources at the beginning of the lesson would make the lesson enjoyable and therefore enhance learner achievement. Introducing modeled teaching resources at the beginning of the lesson is also critical in building learner confidence while they are interacting with the tools. The findings prove that modeled teaching resources are important instructional tools in acquisition of mathematic concepts and thus enhance learner achievement.

4.6.2. Frequency of Modeled Teaching Resources in Lesson Development

The researcher asked teachers how frequently they used the modeled teaching resources in the development of mathematical concepts to the learner. All of the teachers interviewed admitted modeled teaching resources were part and parcel of their lesson development tools and some could not teach without them. The teachers said modeled teaching resources made learning easy and assisted learners relate numbers and concepts quickly and therefore they used them all the time. They also said modeled teaching resources made learners

master concepts with ease and thus very important teaching-learning tools. The teachers also said modeled teaching resources also motivated the learners during lesson time and therefore made teaching easy and thus frequently used them in the lesson development stage.

4.6.3. Frequency of Modeled Teaching Resources in Lesson Assessment and Conclusion

The teachers who were interviewed said modeled teaching resources were very important in activating the memory of the learner to remember what had been taught with ease. They said since modeled teaching resources are tools that made relating numbers and concepts easy, they often used them to enable the learner recall what had been taught. Equally, modeled teaching resources made peer learning simple and learners were able to sort numbers in groups without difficulty since each learner was able to independently relate the modeled instructional resources with number concepts they had been taught.

4.7 Teacher Attitude towards Modeled Teaching Resource

Objective four sought to examine the influence of teacher attitude on using modeled teaching resources in teaching mathematical concepts. The findings are shown in table 9.

Table 9: Teacher Attitude in Using Modeled Teaching Resources

Teacher attitude	Frequency (n)	Percentage	Mean Rank
Inadequate storage facility	6	86%	1
Enrolment	4	57%	2
Lack of variety of modeled teaching resources	4	57%	2
Lack of class control	3	43%	4
Lack of time for their development	3	43%	4
Class size (room)	2	29%	6
Lack of time to use resources	1	14%	7

The findings in table 9 show that the majority of teachers (N=6, 86%) attribute lack of storage facilities as a major challenge followed by enrollment as admitted by 4 (57%) teachers. This was because teachers do not have secure lockers to store the modeled teaching resources and therefore the resources are lost or get destroyed easily. Three teachers (43%) said the resources sometimes lead to lack of class control thereby hindering them from delivering the mathematical contents effectively. The teachers interviewed had positive views of the modeled teaching resources despite their shortcomings. Moreover, they noted that the parents of the early year education learners were not sure of the relevance of modeled teaching resources in their children's intellectual development. The school administrations on the other hand were fully aware of the importance of the modeled teaching resources and offered support especially in buying the learning materials despite the financial constraints they face. Little parental support witnessed in many of the visited schools is highlighted as a major factor of demoralization to the pre-school teachers and therefore do not support learners with learning difficulties.

The findings reveal that teachers view modeled teaching resources as vital elements that assist them to effectively and efficiently deliver content thereby enhancing leaner's achievement in counting numbers. Smith (2006) affirms this in his observation that through the use of modeled teaching resources during lessons in counting numbers in early year's education, learners are in a position to actively construct mathematical understanding of their own and therefore is the most suitable tool for teaching learners with learning disabilities. Similarly, teachers have a very positive attitude towards the modeled teaching resources despite their shortcomings such as money and time constraints.

4.8 Impact of Modeled Teaching Resources on Learner Performance in Counting Numbers

Objective five sought to find out whether there is learner improvement in counting numbers when taught using modelled teaching resources. The instrument used to capture this objective was the performance tests designed in the form of pre tests and post tests. The tests were conducted orally and focused on testing learner achievement in different arithmetic concepts such as pairing numbers, sorting numbers, matching numbers and counting numbers before and after mathematical lesson with the aid of modelled teaching resources. Early year education learners were paired in groups of two boys and two girls each. The tests were administered to twelve groups of learners and the results are shown in table 10.

Table 10: Frequency Table of Performance Tests

EYE School	Pre Test Scores	Post Test Scores	Improvement Scores
NAMA-SC 002	10.25	11.75	1.5
NAMA-SC 004	10.75	11.5	0.75
NAMA-SC 006	9.25	11	1.75
Mean Score	10.08333	11.41667	1.33334

The results show that the overall mean score for pre-tests was 10.083 while that of the post tests was 11.417, an indication that there was an improvement in the overall scores after being taught using modeled teaching resources. All the sampled schools also recorded a positive increase in the score indicating modeled teaching resources are useful instructional materials across the three schools. The findings prove that modelled teaching resources deliver significant results when consistently used in mathematical lessons. During the performance tests, one teacher said the following to the researcher "Modeled teaching

resources challenges the learner to think, helps the learner to discover, assists in discussing concepts and relate to things at home and environment", affirming that the resources enhance the development of concepts and thus record growth in performance.

The study further analyzed the mean scores of the sampled schools and results presented in table 11.

Table 11: Summary Descriptive Statistics of Performance Test Results

Mathematical Concept	Test type	N-groups	Group Mean Score
pairing	Pretest	12	2.5556
	Post test	12	2.7778
sorting	Pretest	12	2.4444
	Post test	12	2.7778
Matching Nos. to their value	Pretest	12	2.2222
	Post test	12	2.8889
counting	Pretest	12	2.5556
	Post test	12	2.8889

The findings in table 11 show that the pre-test mean score in matching numbers was 2.2, while that of post tests was 2.8. Similarly, the pre-test mean score of sorting numbers was 2.4, while that of post test was 2.7. The mean score on pre-test on counting numbers was 2.5, while that of post-test was 2.8. The tests reveal that modelled teaching resources improve the learner achievement in different mathematical concepts as expressed by the results. One teacher noted that they help learners develop concepts easily by saying the following "Modeled teaching resources are important for teaching number concept", as indicated by the study findings.

The findings show that there was a major improvement in matching numbers than in pairing them. The pre-test mean score in matching numbers was 2.2 while that of post tests was 2.8. The pre-test mean score of sorting numbers was 2.4 and that of post test was 2.7. Similarly, the mean score on pre-test on counting numbers was 2.5 while that of post-test was 2.8.

The test showed that of the four concept tests, matching numbers was significant (p-value = 0.16) at 95% confidence level indicating that modelled resources are significant in building mathematical concepts. A spearman correlation tests (0.599, p-value = 0.009) also shows that there is a strong correlation between modelled teaching resources and the total results of the learners. By implication, the use of resources in teaching mathematics improves learner performance. One teacher said the following "Modeled teaching resources were learning materials that aid in acquisition of concepts", indicating they help in mastering and developing arithmetic reasoning in the early year education. Further results are presented in table 12.

Table 12: T Tests on Mean Totals

Arithmetic concept	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Pairing	-.970	16	.346	-.22222	.22906
Sorting	-1.177	16	.257	-.33333	.28328
Matching	-2.683	16	.016	-.66667	.24845
Counting	-1.251	16	.229	-.33333	.26644

The results in table 12 indicate that each test recorded an improvement of at least 0.2 marks. This proves that modeled teaching resources have an impact on learner performance on mathematical reasoning. The tests also prove that learner achievement is influenced by the use of modeled teaching resources. Teachers equally concur that modeled teaching

resources enable learners to understand number concept easily and enhance their performance in mathematical tests. Rideout (2006) affirms this finding by noting that modeled teaching resources are vital in the early years learning of a child since it supports the intellectual development in the acquisition of mathematical concepts such as counting numbers. Similarly, Ninio (1983) explain that modeled teaching resources help a learner to acquire high level mathematical concepts such as counting and thus should be a regular instructional resource used by teachers in teaching mathematical concepts.

CHAPTER 5

SUMMARY FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents summary of the findings, recommendations and possible areas of further study.

5.2 Summary of the Findings and Conclusions

The findings in objective one reveal that different teachers use different methodologies to motivate learners given all learners have different needs. A good number of teachers use songs to motivate learners in the beginning of the lesson. Other teachers integrate modeled teaching resources into the songs to fully capture the attention of the learner right at the beginning of the lesson.

The findings reveal that modeled teaching resources are vital instructional materials that motivate learners in all the phases of a mathematical lesson. There are effective in the lesson introduction stage as witnessed in 2 (67%) classes observed as they arouse learner interest (N=2, 67%) and create positive learning environment (N=2, 67%). They are very effective in enhancing learner participation during the lesson development phase as they spur individual and group activities (N=2, 67%). Modeled teaching resources aid in the development of mathematical concepts as they burn the information in the learners mind thereby enhancing cognitive development. They also enhance learner confidence (N=3, 100%) as witnessed in all the three classes thereby making leaning enjoyable. Modeled teaching resources are crucial in the lesson assessment and conclusion stage as they build faculties in the learners mind and thus are able to remember and recall what has been taught.

The findings disclose that Modeled teaching resources have become part and parcel of instructional tools used by teachers in every mathematical lesson. The teachers observed and interviewed said that modeled teaching resources have been inculcated into their teaching styles and they could no longer teacher mathematical concepts without them. They admit that modeled teaching resources are teaching aids that help in managing learners as well as delivering the arithmetic contents. All the teachers admitted that they use the resources in introducing mathematical lessons as they speed up the process of learning, developing the lessons as they keep learners alert and active throughout the process, assessing the lessons and concluding the lessons. These enable learners to extend the knowledge to their immediate surroundings and thus enhance learner achievement.

The findings reveal that teachers attitude towards using modeled teaching resources is positive despite the challenges they draw. This is because the benefits of using the resources eclipse the disadvantages. They associate modeled teaching resources with better understanding of mathematical concepts and improved performances in the assessment tests. Modeled teaching resources also enhance learner confidence and participation and thus make the teaching-learning process enjoyable. Lack of storage facilities (N=6, 86%) is the main challenge exhibited by teachers followed by non-uniform enrollment of learners. Teachers however argue that parental support is vital in mitigating these challenges since many parents barely assist teachers with the resources.

The findings proved that modeled teaching resources have a direct impact on learner performance. A spearman correlation tests on produced a value of 0.599 with a p-value of 0.009 indicating that learners are able to acquire new concepts when taught with modeled teaching resources. The findings therefore affirm earlier studies by Rideout (2006) and

Ninio (1983) that concluded that modeled instructional materials support intellectual development of an early year learner and therefore should be adopted by teachers.

The study reveals that modeled teaching resources are not just tools to be used in classroom setup alone as they represent other aspects in life. The results prove that modeled teaching resources if availed at home can further boost learner achievement in counting numbers since they would regularly interact with the tools and extend the learning process to homes. In doing this, learner masters the concepts faster and thus improves his/ her skills in arithmetic. Teachers observe that many learners forget the concepts easily once they leave the classroom and barely extend the learning process to the immediate home environment.

5.3 Conclusion

The study proposed to investigate the influence of modeled teaching resources in early year learner's achievement in counting numbers and the following are the conclusions pinned in the study. Modeled teaching resources assist learners understand mathematical concepts easily as they burn the information into the learners mind thereby enhance mastery and understanding of the mathematical concepts being taught by the teacher. They easily make linking of analogue to digital literacy easy as witnessed by the researcher since the concepts of touch, play and learn are also embedded into the digital world. Modeled teaching resources are interesting to both teachers and learners as they involve a lot of engagement and interaction and thus are useful instructional materials.

The study produced a strong correlation of 0.599 between the use of modeled teaching resources and learner achievement. This proves that modeled instructional materials have a direct impact on learner achievement in mathematical concepts. This success is linked to positive learner attitude towards learning in a pleasant learning environment created by the

modeled teaching resources. Modeled teaching resources therefore enhance cognitive development of a learner and affirm Piaget's (1952) interpretation that learners develop new knowledge in an environment where they are allowed to engage and interact with resources.

5.4 Study Recommendations

The study recommends that all early year education teachers should always use modeled teaching resources in teaching mathematical concepts to early year education learners as they aid in building mathematical concepts such as counting numbers. They make teacher's work easier and at the same time, enable the leaner to fully concentrate on the teaching-learning activities taking place.

The study also recommends that early year education classes be capped to manageable number since class size not only affects learner achievement, but teacher attitude as well. Learners tend to learn more in smaller classes than in larger ones. Teachers too enjoy teaching in smaller classes as found in the study.

The study suggests that more diverse and advanced modeled teaching resources should be introduced in early year education classes. The current modeled teaching resources are quite effective in building concepts of counting numbers. However, with the advancement in technology, early year education learners need to be exposed and therefore modeled teaching resources like digital white boards should be considered.

Finally, the study recommends that enough civic education be carried out to inform parents and the county governments as well on the relevance of modeled teaching resources. If this is done, early year education teachers will not lack sufficient modeled teaching resources

during teaching – learning process as all the stakeholders in the early year education such as parents and county governments will be actively involved in the provision of modeled instructional resources to the early year education centers.

5.4 Suggestions for Further Research

The context of this study was public early year education schools attached to public primary schools in Mukuru Kayaba area. However, there are some many private pre-schools within Mukuru Kayaba which also provide early childhood education. This study therefore recommends a similar study with focus on private early year education schools in Mukuru Kayaba informal settlements in Makadara Sub-County.

The study also focused on a specific area in Makadara Sub-County. However, Nairobi County has other 17 sub counties hence the study recommends a similar study in the other counties in Kenya.

REFERENCE

Alfieri, L., Brooks, P. J., Aldrich, N.J., & Tenenbaum, H. R. (2011). *Does Discovery-based instruction enhance learning*? Washington DC.

Allen, K. E. & Hart, B. (1995). *Education Technology*. London: John Willey and Sons Publishers.

Askew, M., Brown, M., Rhodes, V., Johnson, D., & Wiliam, D. (1997). *Effective Teachers of Numeracy: Final Report*. London: Kings College.

Boaler, (2009). *What Is Math Got Do With It? How Parents and Teachers Can Help Children Learn To Love Their Least Favorite Subject*. Penguin: New York.

Bruner, J. S. (1961). *The Act of Discovery*. Harvard Educational Review.

Burn, M. (1992). *About Teaching Mathematics:* A.K-8 Resource.

Burn, M. (1995). *The I Hate Mathematics!* Book Coreto, Ca Yoila Bolly Press

Charbonne, K. J., Marley, S. C., & Selig, J. P. (2013). A meta-analysis of the Efficacy of Teaching Mathematics with Concrete Manipulatives. *Journal of Educational Psychology.*

Clement, D.H., Hand, T.B. (1990). Constructivist Learning and Technology. *Arithmetic Teacher.*

Cramer, K., & Henry, A. (2013). Using Manipulative Models to Build Number Sense for Addition of Fractions. *Yearbook (National Council of Teachers of Mathematics),*

De Leach (2000). B*uilding Knowledge and Meaning Through Modelling, Research Article*. Madison: University of Wisconsin.

Dewey, J. (1929). *The Quest for Certainty*. New York: Minton.

Fiona, L. & Alice, H. (2011). *Children's Errors in Mathematics: Understanding Common Misconceptions in Primary Schools Learning Matters*. (2nd Edition). Britain. London: Sage publications Ltd.

Ford, A. (2014). *Modeling the Environment,* (2nd Ed). Washington State University, Washington: Island Press.

Gachuki, (2012). *Impact of Instructional Materials on the Learning of Number Value.*

Gilbert, S.W., & Ireton, S.W. (2003). *Understanding Models in Earth and Space Science.* Arlington: NSTA Press.

Gilderdale C.; Kiddle A.; Lord E.; Warren B. and Watson F. (2007). *Approaches to Teaching Mathematics: A toolkit for international teachers.* Cambridge: Cambridge University Press.

Jason, U. (2012). *Improving Oral Performance through Interventions Flashcards*. Centro: Colombo Americano.

Jenni, B. (2012). *Manipulatives in the Primary Classroom. Millenuim Mathematics Project*. Cambridge: University of Cambridge.

Jonassen, D. H. (1994). *Toward a Constructivist Design Model.* Educational Technology.

Kabiru, M and Njenga, A. (2007). *Child Development*. Nairobi: Nairobi Focus Publishers.

Land, S. M., & Hannafin, M. J. (2002). *Student-centered Learning Environments*. In D. H. Jonassen & S. M. Land (Eds.), Theoretical Foundations of Learning Environments (pp. 1–23). Mahwah, New Jersy: Lawrence Erlbaum Associates, Inc.

Lee, C. (2000). Modeling in the Mathematic Classroom. Mathematic Teaching. *Journal Item*, 2010 http://www.atm.org.uk/journal/archive/mt171.html

Lee, C., & Chen, M. (2010). Taiwanese Junior High School Students' Mathematics Attitudes and Perceptions towards Virtual Manipulatives. *British Journal of Educational Technology,*

Lesh, R.A. (1999). Applied Problem Solving in Early Mathematics Learning. *Unpublished Working Paper:* Illinois: Northwestern University

Moyer-Packenham, P. (2001). Are We Having Fun Yet? How Teachers Use Manipulatives to Teach Mathematics. *Educational Studies Mathematics*, 47. 175-197. 10.1023/A:1014596316942.

Mugenda, O.M. & Mugenda, A.G. (2003). *Research Methods: Qualitative and Quantitative Approaches*. Nairobi Kenya: African Center of Technology Studies (A.C.T.S).

National Association for the Education of Young Children, NAEYC (2003). *State Policies that Promote Early Childhood Mathematics*. Retrieved/ February 2007 www.naeyc.org 2009/critical/pdf/math-survey.pdf

Ninio, A. (1983). *Joint Book Reading as a Multiple Vocabulary Acquisition Device. Developmental Psychology*. Jerusalem: Hebrew University of Jerusalem.

Olie, O. (2007). *Education Studies in Mathematics*. Netherlands: Academic Publishers.

Orodho, J .A., Wenceslas N., Odundo, P. & Ndirangu, P. (2016). *Quantitative and Qualitative Research Methods: A Step By Step Guide to Scholarly Excellence* (1st Ed), Nairobi: Kanezja Publishers and Enterprises

Otiende, J. E. (2006). *An Introduction History of Education*. Nairobi: University of Nairobi Press.

Piaget, J. (1952). *The Child's Concept of Number*. New York: Humanities Press.

Piaget, J. (1980). *Language and Learning, the Psychogenesis of Knowledge and Its Epistemological Significance*, In M. Piatelli-Palmarini (Ed.), Cambridge, MA: Harvard University Press.

Rideout, V. and Hamel, E. (2006). *The Media Family: Electronic Media in the Lives of Infants, Toddlers, Preschoolers and Parents*. Menlo Park, CA: Kaiser Family Foundation

Ruzic, R. & O'Connell, K. (2001). *Manipulatives. Enhancement Literature Review*. http://www.cast.org/ncac/Manipulatives1666.cfm.

Silver, J. Carnine, D.W., Stein, M. (1981). *Direct Instruction Mathematics.* Columbus: Charles E.Merril.

Smith, S.S. (2009). *Early Childhood Mathematics,* (4th Ed.) Boston: Pearson.

Sowell, E. (1989). Effects of Manipulative Materials in Mathematics Instructions. *Journal for Research in Mathematics Education,*

Sutton, J., & Krueger, A. (Eds.) (2002). *EDThoughts: What We Know About Mathematics Teaching And Learning.* Aurora, CO: Mid-Continent Research for Education and Learning.

Swan, P., Marshall, L., de Jong, T., Mildenhall, P., & White, G. (2007). *Are Manipulative Being Used in Schools*? *If so, how? If Not, Why Not?* Proceedings of the Australian Association for Research in Education. Fremantle: AARE.

Suydam, M. M. & Higgins, (1976). *Review and Synthesis of Studies of Activity-Based Approved to Mathematics Teaching.* Final Report NIE contract 400-75-0063.

Treacy, R McLaughlin, T.F., Derby, K.M. & Scheutter, E. (2012). *The Effects of Flashcards and Students Selected Reinforcers with Goals and Additional Practice with Multiplication Facts for Two.* Journal Article

Van Houten, R., & Rolider, A. (1989). An Analysis of Several Variables Influencing the Efficacy of Flash Card Instruction. *Journal of Applied Behavior Analysis.*

Vygotsky, L. S. (1962). *Thought and Language*. Cambridge, MA: MIT Press.

Wasike, D. W., (2006). Effectiveness of a Language Based Program in School Mathematics on Student Understanding of Statistics. *Journal for Research in Mathematics.*

Wawire, V.K. (2006). *Factors that Influence Quality and Relevance of ECDE in Kenya*. Unpublished Med Project. Nairobi: Kenyatta University

Wendoh, M. (2012). Influence of Models on the Learning Outcomes in Mathematical Activities in Pre-school in Kakamega Municipality. Nairobi: University of Nairobi Press

Werner, S., Praxedes, M. & Kim, H. (2007) Organizational Research Methods: The reporting of nonresponse analyses in survey research, University of Houston: Sage Publications

Whitehurst, Grover J., Arnold, David S., Epstein, Jeffery N., Angell, Andrea L., Smith, Meagan,Fischel, Janet E. (1988). *Developmental Psychology*, Vol 30(5), American Psychology Association

APPENDICES

Appendix I: Letter of Approval

UNIVERSITY OF NAIROBI
COLLEGE OF EDUCATION AND EXTERNAL STUDIES
DEPARTMENT OF EDUCATIONAL COMMUNICATION AND TECHNOLOGY

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P.O. BOX 92.00902 KIKUYU

DATE: 27 April 2017

REF: UON/CEES/C/4/18

TO WHOM IT MAY CONCERN

SUBJECT: OBONGO LUCY ADHIAMBO - REG NO. E57/80502/2015

This is to certify that **Obongo Lucy Adhiambo** Registration Number: **E57/78724/2015** is a student in the Department of Educational Communication & Technology, School of Education, College of Education and External Studies. She has completed her course work in Master of Education in Early Childhood Education.

Any assistance accorded to her will be highly appreciated.

27 APR 2017

for: **PROF. PAUL A. ODUNDO**
CHAIRMAN, DEPT. OF EDUCATIONAL COMMUNICATION & TECHNOLOGY

Appendix II: Classroom Observation Form Guide

Name of the school …….. Date ……. Time ……...

Total No. of Learners…….……

No. of Male Learners…….……

No. of female learners……

The guide focuses on 4 main areas of teaching and learning mathematical concept in the early year education setup;

Please rate how effective the modeled teaching resources influence learner achievement in the following phases;

Lesson Introduction				
Attribute	Not Effective (1)	Somewhat effective (2)	Effective (3)	Very Effective (4)
Song				
Arouse learner interest / link with learner experience				
Positive learning atmosphere				
Lesson Development				
Attribute	Not Effective (1)	Somewhat effective (2)	Effective (3)	Very Effective (4)
Learner participation				
Individual / group activities				
Concept development				
Effective learning				
Learner confidence				
Positive leaning environment				

Lesson Assessment				
Attribute	Not Effective (1)	Somewhat effective (2)	Effective (3)	Very Effective (4)
Concept mastery				
Teacher's questioning				
Feedback				
Peer learning				

Lesson Conclusion				
Attribute	Not Effective (1)	Somewhat effective (2)	Effective (3)	Very Effective (4)
Song				
Positive environment				

Appendix III: Teacher Interview Guide

This purpose of this interview is to collect information regarding the influence of Modeled teaching resources on the learning of mathematical concepts in early year education. This information will only be used for the purpose of the study and will be treated with the utmost confidentiality as the information will not be shared to other parties without the authority and knowledge of the respondents.

Background Information

Gender: _____ (M/F)		
Total Teaching Experience:_____(yrs)	Teaching Experience in current station: _____(yrs)	
Size of Class:	Girls _____	Boys _____
Highest Qualification	Certificate	[ ] (1)
	Diploma	[ ] (2)
	Bachelors in Education	[ ] (3)
	Others: _____	[ ] (4)

Use of Modeled Teaching Resources

1. What is your preferred teaching style?
2. What do you understand by Modeled Teaching Resources?
3. Do you use modeled teaching resources during teaching of mathematical concepts?
4. How frequent do you use modeled teaching resources in your lessons?
5. Do you use modeled teaching resources during teaching of mathematical concepts?

   How frequent?
6. What types of modeled teaching resources do you use especially in teaching mathematical concepts of counting numbers 1 to 10?
7. Do Modeled teaching resources make teaching/ learning process interesting?

   How_____
8. What's your opinion regarding the use of modeled teaching resources during teaching of mathematical concepts?
9. Do parents / school administration recognize what modeled teaching resources are?
10. Do parents/ school administration and county government provide modeled teaching resources for learning purposes?

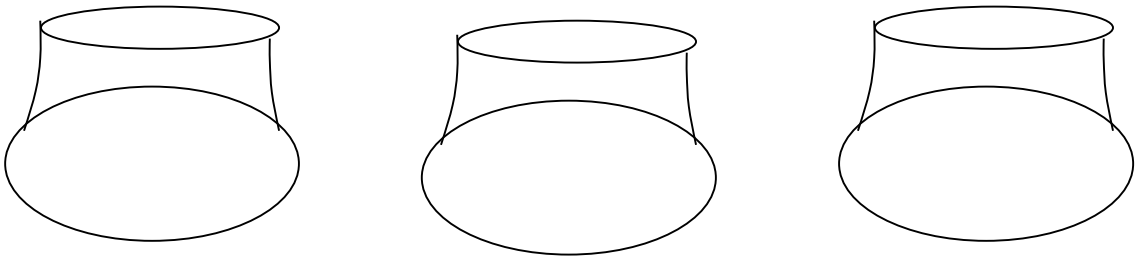
Appendix IV: Performance Test – Pre Test

1. Pair the numbers

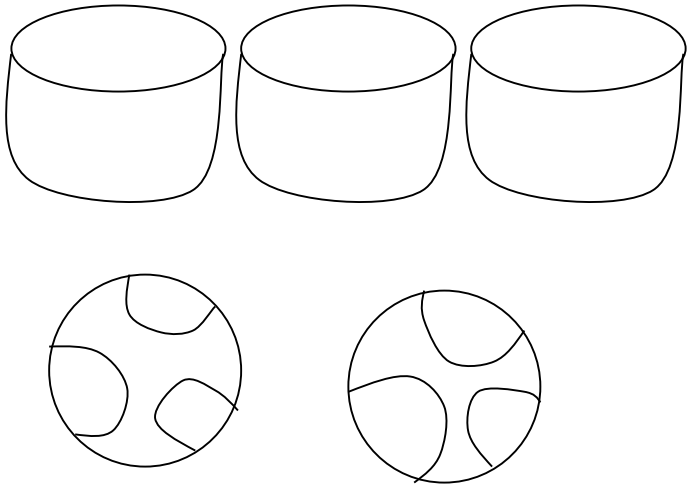
2	**5**
5	**3**
3	**2**

2. Sort numbers according to likeness

4 6 3 6 4 3 3 6 4

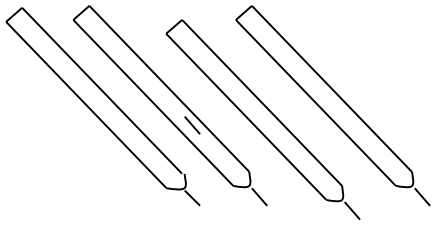


3. Match number with value



2

4



3

4. Fill in correctly

1, 2, __, 4, 5, __, 7, 8 __,10

5. Write numbers 1 to 10

__ __ __ __ __ __ __ __ __ __

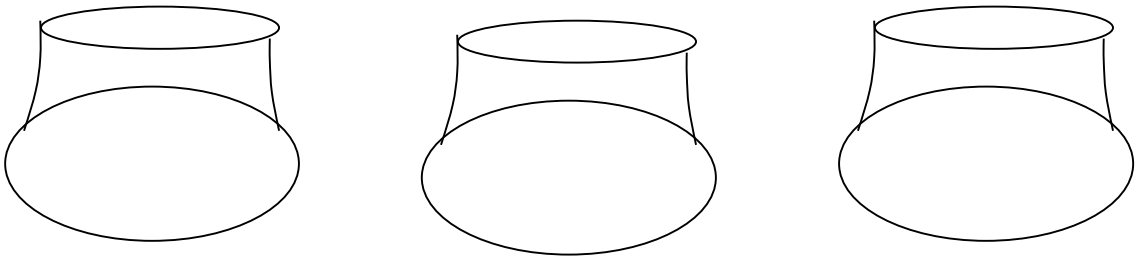
Appendix V: Performance Test – Post Test

1. Pair the numbers

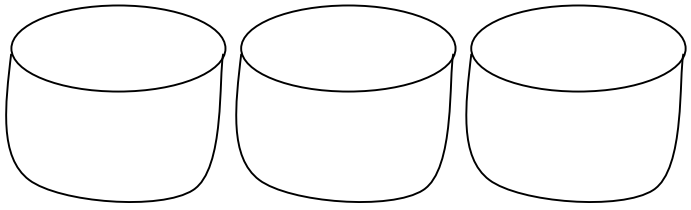
2	**5**
5	**3**
3	**2**

2. Sort numbers according to likeness

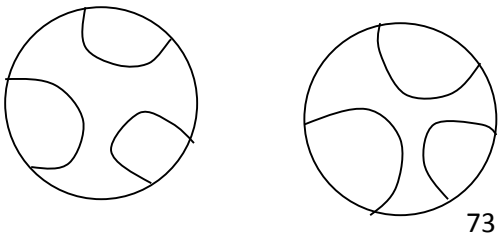
4 6 3 6 4 3 3 6 4



3. Match number with value



2



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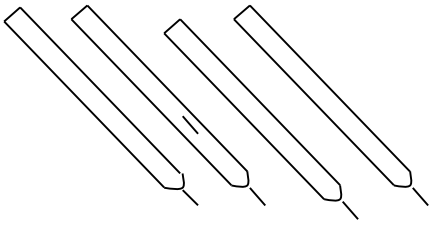

3

4. Fill in correctly

1, 2, __, 4, 5, __, 7, 8 __, 10

5. Write numbers 1 to 10

__ __ __ __ __ __ __ __ __ __

Appendix VI: Early Year Education School Code List

List of Schools in the Study population

School Code	Codes
Mukuru Primary School	NAMA-SC 001
St. Bakhita Primary School	NAMA-SC 002
St Catherine primary school	NAMA-SC 003
Mariakani Primary school	NAMA-SC 004
Star of Hope primary school	NAMA-SC 005
St Elizabeth primary school	NAMA-SC 006