

**INFLUENCE OF INTERACTIVE TEACHING METHODS ON  
ACHIEVEMENT IN MATHEMATICS AMONG PRESCHOOL  
CHILDREN, IN NYANG'OMA ZONE, MUHORONI DISTRICT,  
KENYA**

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## **DECLARATION**

This Research Project is my original work and has not been submitted for any academic award to any other Institution.

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This Research project has been submitted for examination with my approval as the University Supervisor.

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## **DEDICATION**

This research work is dedicated to my wife Margaret Atieno Onyango and my younger daughter Velma Adhiambo.

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## **LIST OF ABBREVIATIONS AND ACRONYMS**

ECDE	-	Early Childhood Development and Education Centers
KICD	-	Kenya Institute of Curriculum Development
NACECE	-	National Center for Early Childhood Education
SMASSE	-	Strengthening of Mathematics and Science in Secondary School Project
QASO	-	Quality Assurance and Standard Officer
DICECE	-	District Center for Early Childhood Education
INSET	-	In-Service Education and Training
KNEC	-	Kenya National Examination Council
KCPE	-	Kenya Certificate of Primary Examination

## ABSTRACT

The place of mathematics in the curriculum and the achievement of the children studying it have been identified as needing special attention. Mathematics is widely recognized by pupils, parents and teachers to be the important qualification for employment or for further studies. Many teachers teach mathematics without knowing enough about the subject or about the current ideas of teaching it. The purpose of this study was to investigate the influence of interactive teaching methods on pre-school children's achievement in mathematics in Nyang'oma zone, Muhoroni District. An ex-post facto research design was used in the study. The study targeted a population of 18 preschools, 54 teachers, and 720 children. The instruments for the study were questionnaires, interview for teachers and document analysis guide. Data were analyzed using descriptive statistics. The statistics calculated were frequencies, means and percentages. The findings of the study established that Interactive methods greatly promote the achievement of the child in mathematics activities. Most children who were involved in using interactive methods in learning recorded high mean scores in number work activities. Therefore the study recommends the use of interactive methods in preschools to promote children's achievement in mathematics. Teacher's qualification, workload and participation of children are among other challenges that tend to affect the achievement of mathematics in the zone. The study further recommends that more teachers be recruited since this would have a direct impact on children's achievement through a change in teaching methods, and teachers with high experience in mathematics teaching be designated as baby and middle class instructors. The ministry of education to in-cooperate SMASSE programmes in ECDE to increase competence in handling the methods used in mathematics instruction, and a uniform test as a measure of learners ability on qualification to join standard one. Further research to be carried out to compare the most method used with learner's general feelings, and advanced research be carried out to verify how long it would take with in progress preschool to use interactive teaching methods.

## CHAPTER ONE: INTRODUCTION

### 1.1 Background to the Study

Education produces an academically developed mind helping learners to develop a thorough knowledge and understanding of the subject. It equips learners with the relevant knowledge and skills that they need in the world of work. Ogutu and Wandibba (1987) have defined it as a process by which people acquire knowledge, skills, habits, values and attitudes. It offers a forum in which learners can socially develop and take their roles in society (Farrant,1997).Viewing it this way, education provides sufficient people into the academic community who are equipped enough to adopt to the needs of a changing society. In regard of these aims in mind, economies cannot go to rest before refurbishing their school system in order. In modern economies no development can be uttered without education as it is the basic tool in the development of science, technology, commerce and industry and thus crucial in the economic development of modern society. All over the world, Governments have been utilizing huge amounts of money in improving the quality of the respective education system. This has been realized in the field of formal education.

Mathematics is generally regarded as one of the most essential subjects in the school curriculum (Orton and Frobisher, 1996). Mutunga and Breakell, (1992) defines Mathematics as an organized body of knowledge where ideas, principles and concepts involving numbers are build up logically. Teaching Mathematics in secondary school is equated to security, certainty, truth, beauty, insight, structure and architecture (Jonstone-Wilder, 1980) observed. According to Schloglmann, mathematics is a part of our culture and democratic principles such as equality, justice and so on needing an operational

concretization. The Kenya Institute of Curriculum Development 2008 (KICD) states that preschool mathematics objectives needed to develop interest and positive attitudes towards mathematics, and to stress the benefits of mathematics in daily life. Mathematics is a basic tool in the development of science and technology, commerce and industry hence aids in the economic development of a modern society. Furthermore, mathematics is used as a 'filter' or 'handle' more after than any other subject (Orton and Frobisher, 1966). All children therefore need to be equipped with this essential tool of productiveness and to varying extents according to their abilities, so that in time they may make their contribution to the economy and the government of their societies and also improve their own qualities as human beings.

The development of highly skilled scientists and technical manpower requires a strong grounding in mathematics. An emphasis on mathematics education will ensure that we have an increasingly competitive workforce to meet the challenges of the 21<sup>st</sup> century (Neunzet, 2005).

Several countries question the mathematics attainments of children in schools. Britain had its share in the great debate which led to confront inquiry (Costello, 1991). Costello (1991) observes that "anxiety about standard of achievement in school mathematics appears to be a permanent feature of British life with complains of declining standards being made regularly in the press and by government organs for well over hundred years". In an attempt to check some of the challenges in mathematics, the government gives high priorities to in-service education and training of mathematics. It is in this line that the Kenyan government launched a project on 27, Feb 1998. The strengthening of

mathematics and science in secondary school project (SMASSE) and In-Service Education and Training (INSET) was launched against a backdrop of poor achievement in Kenyan school in mathematics and science subject.

As cited by Johnston-wilder, (1980), Margaret observes that it is critical of mathematics teachers to have an admiration of competence in manipulating and have a positive attitude towards the big mathematical concepts. She also asserts that the teaching of mathematics demands the teacher not only has solid knowledge of the content to be covered but also to have at his/her disposal a stock strategies and approaches which will enable him/her to impart that content to children with meaning and understanding. Above all subjects, in mathematics, the individual must grasp the concept for himself/herself, must be free to apply his/her own judgment to the problem according to well defined rules and in the line of data given (Kenya National Examination Center, 1981) (KNEC). The selection and arrangement of elements of corrections and the various ways in which they are introduced to the pupils is the more specialized meaning of a teaching method, (Pinsen, 1962). There is a wide range of methods, ranging from 'talk and chalk' to experimental and project methods (Edger, 1994). Edger (1994) indicates that people have adopted many different methods in an attempt to improve teaching of the "telling" type. He asserts that the methods have tended to vary according to fashion and the current state of technology (Edger, 1994). Michael (1987) indicates that teaching methods spread over a continuum from the old teaching methods of the expository kind to the new child centered methods. Mathematics teachers can use lecture method, discussion, project, group work, textbook reading, games, slides, mathematical modeling, use of resource people and experiments among others. The

methods are not to be used in every single lesson, but rather the teachers should choose the most appropriate methods in line with the topic and pupils. The choice of instructional methods depends on the strategy used, where as the strategy used depends on the kind of content and objectives of the lesson (Mutunga &Breakell, 1992).

Although old and new methods are equally important, different methods fit different kinds of content. There is always an appropriate method for a given content and teaching strategy. Nowadays, emphasis in mathematics learning is more skewed to methods involving strong experiences and activities rates than the traditional ‘talk and chalk’ method. Such methods include experimentation, model making, plays and acting. Dewey (1944) recognized that understanding of abstract concepts and principles in childhood must be built on a foundation of direct, concrete empirical experience. In this he emphasized that learning which involves interactive with some activity is bound to achieve its objectives. Activity methods, however requires high standard of competence from the learning. This is because the events from the classroom are more difficult to determine beforehand.

Teachers are advised to use progressive methods which are based on the idea of interactive, critical thinking, and group work, creative activities, direct experience and integration. Bad teaching occurs when one uses inappropriate method and results to reduced motivation, increases negative attitudes to learning and yields lower achievement (Brown and Atkins, 1988).A close relationship exists between mathematics teaching methods and achievement. The method used in teaching mathematics is instrumental in determining ones achievement (Keith, 1997). Farrant et al. (1980),

argues that instructional methods contribute toward success in subject teaching. Mathematics teaching at all levels should include opportunities for exposition by the teacher, discussion between the teacher and the pupils and between pupils themselves and appropriate practical work. It also involves practice of fundamental skills and routine of problem solving. Morris(Ed), 1980). Interactive methods are known to keep children motivated and aroused, aid cognition and enhance retention. In interactive learning a learner is capable of applying to wide range of learning. In interactive methods learners are involved in retrieval of information, understanding it by integrating it with the existing knowledge they have and by arrangement of the new knowledge, they are able to produce a new or a desired learning (Bruner, 1965). Interactive learning has much to do with activity methods.

In Kenya, a number of changes have taken place in the education system since independence. The Government has constituted several committees and commissions to determine the way forward for education to come up with more realistic policies which would address challenges and expectations of the people (Elimu Yetu Coalition, 2003). Kenya's vision 2030 aims at transforming Kenya into a newly industrializing middle-income country providing a high quality life of all its citizens by the year 2030. All these aimed at restructuring education system in order to provide quality and relevant education system different from that which existed before.

Mathematics, as a subject has a central role in the development of new technologies to enable Kenya live to this dream. However, teaching-learning of mathematics is experiencing many hurdles. This can be seen clearly in the achievement in national



examinations which is averaged. In undertaking the study, it's influenced by Thuku, (2003) whose one of his suggestions implored researchers to undertake a study in identifying the impact of activity interactive oriented project to children achievement.

**Table 1: Nyang'oma Zone Mathematics Mean Score in K.C.P.E (2010 - 2012)**

Year	2010	2011	2012
Mathematics	51.72	53.32	53.19

**Source: Muhuroni District Education Office; K.C.P.E Analysis Report**

In seeking explanations for this type of results, several questions get asked. Is it the school environment? Is it the quality of teachers? Research pursuing these lines of inquiry are needed; hence the focus on the present study on the influence of teaching methods on learners' achievement in mathematics by preschoolers.

### **1.2 Statement of the Problem**

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

mathematics education for 3-8 years old children was a crucial foundation for future mathematics skills at higher levels of learning.

Early Childhood Education was part of the basic education undertaken by the Kenyan government aimed at laying a good foundation not only for the children at the level, but for the entire education system. Research in childhood development had verified that experiences gained in early childhood influence cognitive and social skills at higher levels of education. This then means that improving mathematics achievement at the E.C.D.E, level should improve mathematics skills at higher levels. Some of the habits of improving this foundation level were through use of interactive teaching methods in place of non-interactive teaching methods. The use of non- interactive methods like lecture method, drill and practice, had failed effectively to communicate the mathematical concepts to learners. The methods had been cited as one of the contributing factors for the minimal achievement Those who used these methods had their classes obtaining below average mean score The study noted that the use of interactive methods such as Play, Small-Group Discussion, Practical work, Games, Demonstration, and Self directed method had their classes score above average mean This is a fact attributed to the ability of the methods to create interest as learners learn by getting involved. This study tried to drop light on the issue by trying to find out how the preschool teachers are using these methods during their teaching learning sessions of mathematics. The study was conducted in preschool institutions in Nyang'oma Zone, Muhoroni District.

### **1.3 Purpose of the Study**

The purpose of the study was to determine the influence of teaching methods used in teaching mathematics, had on learner's achievement. The study was also meant to determine the effects of the teaching methods used by a teacher; Play method, Discussion method, Lecture method, Self- Directed method, and achievement in mathematics.

### **1.4 Objectives of the Study**

The study was set to achieve the following objectives.

1. To determine the effects of Interactive activities on achievement in pre-school mathematics.
2. To examine the effect of Play activity on achievement in pre-school mathematics
3. To determine the influence of Small-Group Discussion on achievement in preschool mathematics.
4. To determine the effects of Games on achievement in pre-school mathematics.
5. To determine the influence of Self Directed learning method on achievement in mathematics activities of preschoolers.

### **1.5 Research Questions**

From the research objectives, the following research questions were to be formulated:

1. What are the effects of interactive activities on achievement in pre-school mathematics?
2. What are the effects of Play on achievement in pre-school mathematics?

3. What is the influence of Small-Group Discussion method of teaching on achievement in mathematics activities on learners?
4. What is the influence of Games on achievement in mathematics activities of preschoolers in Nyang'oma zone?
5. What is the influence of Self- Directed method of teaching on learner's achievement in mathematics?

### **1.6 Significance of the Study**

The study was significant as it focused on methods mainly used by the preschool mathematics teachers while teaching. Its main aim was to collect data on the methods mainly used. The methods were then compared with the final class examination achievement to determine if there was a significant relationship between them. The outcome will be used to provide feedback to teachers as to which methods enhance cognition and retention. Learners and teachers will get feedback on various participations of the teaching methods. To the managers, administrators and other stakeholders message will be relayed on whether teaching load impacts on the methods used hence achievement. The findings of this study will provide the managers with meaningful information as to what numbers of teachers will effectively deliver. The Ministry of Education will use the recommendation in enhancing achievement of objectives of preschool mathematics and assisting the teaching of mathematics by providing ample time in lessons to at least prepare materials intended to invoke experiences, and recruit more teachers. It will also use the recommendation in funding the SMASSE project to preschools to increase competence in handling the Interactive methods used in mathematics instruction.

### **1.7 Delimitation of the Study**

The research was conducted in Nyang'oma zone, Muhoroni District though the factors the study sought to investigate were nationwide. Although the study was to be conducted in all public schools in Nyang'oma zone, only selected children in each school were to be considered. The study only used 160 learners instead of 720 and 8 teachers instead of 24.

Although the study was set to investigate the influence of different teaching methods on children achievement, it did not look at other aspects as learners' level of motivation, provision of learning materials among others. The study mainly used questionnaires, observation, and documentary analysis as its main methods of collecting information, it also used interview method to provide in depth data which was not possible with questionnaires and a chance to ask probing questions.

### **1.8 Limitations of the Study**

Mugenda and Mugenda (1999) defines limitation as some aspect of the study that the researcher knows may negatively affect the generalizations of results but over which he/she has no control . The design used was ex-post facto which had an inherent limitation as it began with an observation of a dependent variable that had already occurred and working out in retrospect for its possible relationship to and effects on, the independent variable that changed with time. The study was conducted in public preschools and the findings may not reflect the situation in private preschools. This was because the private preschools are mainly financial institutions and often are of different management and organization.

Some reluctance was mainly noted in responding to the items in the questionnaire mainly because teachers thought that the research was about to expose specific school's weaknesses. However, the initiative was taken to assure the respondents that confidentiality was to be ensured. Financial constraints was another limitation since the researcher was self sponsored and depended on salary for all the research activities and time limit in data collection.

### **1.9 Basic Assumption of the Study**

The study assumed that:

1. All preschools in the district had trained mathematics teachers who were able to distinguish different methods of teaching.
2. The study was taking for granted and without evidence that the respondents would give accurate and honest responses to the items in the questionnaires.

## 1.10 Definition of Significant Terms

- Academic Achievement:** Mathematics score of the pre-school exam 2013 for pre unit class.
- Games:** The activities children involve themselves in while observing certain rules actively during mathematics teaching and learning by manipulating materials, sorting out number work puzzles involving different operations.
- Lecture:** The presentation of any information orally. It is an uninterrupted verbal presentation by a single speaker to an audience and the responses include; note taking and subjective reactions to remember content.
- Method:** A way of doing something, especially in a systematic way; implies an orderly logical arrangement (usually in steps).
- Narrative/Storytelling:** This is an oral presentation of chain of events accompanied with explanations and questions in relation to their causes and effects.
- Play:** It is an active medium of learning amid the children to experiment with the world around them and the expressive world inside them.
- Pre-school:** The time a child is old enough to go to school. It also refers to a Nursery school, Kindergarten, Day Nursery

- Professional Qualification:** Is a document which shows that someone has successfully finished a course of study which allows him or her to work in one of the professions.
- Self Directed method:** It is learning whereby learners are owners and managers of their own learning process.
- Small Group Discussion:** It is a liberated flowing conversation among the pupils by putting across their opinions and ideas, and to hear those of their peers.
- Teaching Experience:** Is the accumulation of knowledge or skill that results from direct participation in events or activities. Wealth of varieties of methods imparted to learners to acquire knowledge.
- Teaching method:** The principles, and methods of instruction. They keep learners motivated and aroused, aid cognition and enhance retention.



### **1.11 Organization of the Study**

The research study is organized into five chapters. Section one consists of background to the study, objectives of the study, research questions, significance of the study, limitations and delimitations of the study, assumption of the study, definition of significant terms and organization of the study.

Chapter two deals with related literature review under the following sub-headings: introduction, mathematics teaching methods, play, small group discussion, games, self-directed and achievement in mathematics, theoretical framework, conceptual framework upon which the analysis is based.

Chapter three describes the research methodology used. The research methodology includes, research design, target population, sample and sampling procedure, research instruments and analysis techniques.

In chapter four, we look at the data assortment process, analysis of methods used and the interpretation of the findings. Chapter five consists of the conclusion, recommendation and proposition for additional research.

## **CHAPTER TWO: REVIEW OF RELATED LITERATURE**

### **2.1 Introduction**

The chapter presents related Literature on the area of study in the following headings: - Teaching methods, Play activities method, Small Groups Discussion activities method, Games, Self- Directed method, and achievement in mathematics, Summary of Literature Review, Theoretical framework, and Conceptual Framework. Literature review gives a good background information and insight into various issues used in examining the weaknesses and strengths of past studies on the subject and hence their contributions to the study.

#### **2.1.1 Interactive Methods**

Early Childhood period is an age when the child has nearly all rapid development and starts to learn critical concepts actively. Children in this period progress from pre-operation stage to concrete operations, that is, the child passes from visual thinking to mental development (Jacobson, 2001). Children do face mathematical concepts in their daily lives. In the early childhood period, the children experiences about mathematics are acquired mostly through the experiences with objects, depending on the Childs' stage of development. Johnston-wilder (1980) asserted that the teaching of mathematics demands the teacher not only to have a sound knowledge of the content to be covered but also to have a stock strategies and approaches to enable him to impact the content to the learners with meaning and understanding For that matter, an active learning environment and methods are required in the early childhood for development of mathematical concepts and abilities to be used by the child later in life. Therefore the

teacher should plan well a mathematical program and using different techniques in teaching mathematics.

Discussed here under is the mainly used mathematics teaching methods. The methods are, self directed/ text book reading, demonstration, practical work/pupils experiments, narrative/storytelling, play, small group discussion, games, and self directed method among others.

#### **2.1.1.2 Demonstration**

By the term demonstration, we have in mind the illustration and demonstration to the teacher or to the class of mathematical concept or relation by a method in which some physical equipment or device is used and help clarify the explanation (Butter and Waren, 1960). The purpose of demonstration is to illustrate a certain task or skill concept, or principle, so that others can learn and understand more easily and practice what they have learnt. Marlene (1985) indicates that the teacher, student, the whole class or group of children can demonstrate. Marlene also notes that demonstration teaching method is effective because children not only hear, but see how to do something and can then easily try it themselves. It is good to note that many demonstrations involve questioning. Introducing questioning provides a procedure to stimulate the pupils thinking (Popham and Baker, 1970).

The study noted that in the demonstration lessons, the learners were able to hear, and see how to perform certain tasks and could easily try them. This was made possible by the teachers using questioning methods which provided a procedure to stimulate the

learners thinking, as observed by Popham and Baker (1970) However, the study also noted that teachers who used the method registered above average achievement, compared with those who used non interactive methods.

### **2.1.1.3 Practical Work/Pupils Experiments**

The employment of multisensory aids, which are well matched with other classroom activities, can serve a dual purpose; it not only serves to stimulate curiosity, but provides a most effective way of clarifying many mathematical concepts or relations in the course of the experience of associating them directly with physical things (Butler and Wren, 1960). Butler and Wren (1960), adds that this serves a highly significant avenue for natural learning as well as for motivation, and the practice is often referred to as laboratory work in mathematics. Learners are usually provided with activities, and then they are initiated on what to do to attain set goals through handling of objects or equipments (Njoroge 2004). In support to Butler and Wren (1960), Njoroge (2004), Concroft (1982) observed that learning by doing raises learners' level of recall and relation of mathematical contents in long term memory.

Heather (2009) notes that experiences gained through life, education and work, plays a central role in the process of learning and this perspective of learning is called experiential learning or learning by doing. The method also enhances psychomotor skills, helps pupils distinguish mathematical relationships in objects and concretizes mathematical concepts asserts Githua (2002).

The study in conformity with Heather (2009) and Githua (2002) observed that the method improves psychomotor skills and assists preschool children to discern mathematical associations in items and concretizes the concepts. The study also concurred with Njoroge (2004) observing that learning by doing elevates children's level of recall and relation of mathematical contents in long term memory. The study observed that the method was having an edge over non interactive methods in stimulating interest, and the response of the learners revealed that the method creates chances for deeper understanding as they involve the senses of touch, feel, smell, hearing, and sight in stage-managing objects. It is revealed that the learners taught by interactive methods of learning performed better than those taught by other methods.

#### **2.1.1.4 Narratives/ Storytelling**

Narration and Storytelling method involves oral presentation of a chain of events accompanied with explanations and questions in relation to their causes and effects. Based on the learning objectives and content, the story can be about local, national, or international events. For this method to be effective, the teacher should employ techniques like ensuring familiarity with the event being narrated and their relevance to content being taught.

Storytelling arouses the learners' interest, appeals to learners' emotional feelings, makes information to be easily remembered. Wendy Ellyatt (2002) observed that "storytelling/narrative is usually combined with human actions or events that affect human beings. The meaning of event is produced by the part it plays in the whole episode". An ECDE teacher can use this method for effective teaching by choosing

stories that are relevant and of great interest to the target audience. Ngaroga (1994) and Rodgers (2011) noted that some areas of teaching do not render themselves to use of a story.

The study in similar observation with Rodgers (2011) and Ngaroga (1994) asserts that this method of teaching has limitations such as not being able always to find a story that is relevant to what the teacher wants to teach. However, it is observed that Narrative/Storytelling is one of the methods linked with the above average performance of learners than to any other non interactive related methods. The children's achievement was high looking at the outcome of the pre-school exam 2013 pre unit class mathematics. This was attributed to the ability of the method to create curiosity as learners learn by deeply drawn in the task.

## **2.2 Play**

Play is an active medium of learning amid the children that gives them a fine opportunity to learn in a normal way. Children do usually device play, but teachers need to sustain and promote it (Moyles 1989) observed that play help to gain important insights in what children are thinking and feeling as they play. Play allows a child to experiment with the world around him and the expressive world inside him/ her. Fisher (1995) in agreement with Moyles, 1989 observed that children have two classrooms-one indoors and one outdoors. The outdoor play setting is worn as an expansion of the indoor classroom. The activities are designed as indoor activities to encourage motor and social skills as well as to refine existing cognitive structures and make new ones.

Fox (1993) observed that during outdoor play, children of four-five year old gained in addition and subtraction, shape identification, patterning, number sense, sequencing of events, use of ordinal numbers. For the development of their fine and large or gross motor movements, for the growth of the child's eye- to hand coordination, it is important for her to play with the natural things around her.

Robert S Siegler noted that play is a very simple but authoritative method for building up children's number sense that involves playing with number board games. This approach reinforces the impression of early childhood education that children can learn through play. Farrant (1997), observe that play serves a number of precious functions because it exercises' competencies, stimulates imaginations and facilitates experimentation afar the real level of development. Play in a rich environment provides dear opportunities to explore and to assume activities that can be surprisingly difficult from a mathematical point of view and at the same time engross fun, social learning, and other kinds of learning, as in the book reading example. The teachable instant involves the teachers' careful observation of children's play and other activities to identify the impulsively emerging situations that can be utilized to promote learning .During free play, teachers spend very little time with children (Seo and Ginsbug, 2004) stated, or tend only to manage their behavior (Kontos, 1999) observed as opposed to their learning.

The study registered that teachers who used play and other experiential methods had their classes score above average. This was as a result of the methods generating interest as preschool children learn by searching out information. Play method, as attested by

Fox (1993) allows the learner to develop fine and large motor movements, growth of eye-to-hand coordination. The study, in concurrence with Farrant (1997) and Moyles (1989), noted that the method helps the learner to exercise competence and facilitates experimentation, and to explore, taking the activities head on, that can be surprisingly difficult from a mathematical point of view. In accordance, it was realized that the teachers who used the method as confirmed by the exam test administered had their learners scored above average achievement.

### **2.3 Small Group's Discussion**

Discussion consists of questions, answers or comments by other teachers and pupils. Since it involves feedback and pupils participation, one would expect it to be an effective method of teaching (Perrot, 1982). Petty (2001), observes that a discussion involves a liberated flowing conversation, giving pupils an opportunity to put across their opinions and ideas and to hear those of their peers. In small group discussions, pupils form their own two to six member groups (Sharan and Sharan, 1992). After choosing subtopics from a unit that the entire class is studying, the groups break their subtopics into individual tasks and carry out their activities that are essential to prepare group reports. Each group then makes a presentation or display to communicate its findings to the entire class (Sharan and Sharan, 1992).

Fischer and Raymond (2005) in agreement with Petty, 2001 and (Sharan and Sharan, 1992) noted that cooperative learning involves the use of small groups to foster effective mathematical teaching where each child is expected to participate fully in discussion while it is expected that there will be no dominance by one child in a group.



In harmony with Fischer and Raymond (2005), Petty (2001) and (Sharan and Sharan, 1992), the study noted that the method makes preschool children involved in a liberated graceful discussion placing across their opinions and ideas and also listen to their peers. The method promotes interaction amongst preschool learners, and encourages constructive competition. By observing the outcome of the exam test given shows that the method gave the learners who used it a constructive competition by achieving higher marks than those who used methods like lecture, drill and practice.

## **2.4 Games**

Games refer to all activities children engage themselves in while observing certain rules actively, during mathematics teaching and learning. The games range from child's self initiated activities involving one, or more individuals to teacher designed games aimed at meeting specific learning objectives. These games involve manipulation of materials, addition and elimination, sorting, drawing and working out number work puzzles involving different operations.

Mathematical games can be played in whole class, small groups or paired settings. They are resource that are highly motivating to children and, consequently, encourages greater levels of concentration and engagement with mathematics. During these games the teacher plays along with the children as she/he offers direction and help, emphasizing the areas of concern in the process of teaching and learning. Games can be used in different ways to consolidate learning, practice skills, explore mathematical relationships and develop problem-solving strategies. Parr (1994) observed that games ' can inspire people to give repeated practice to skills of mental arithmetic and then do the

whole thing again simply because they want to do better the second time around'. While such games do permit for the use and submission of skills in a different context, when choosing these type of games, teachers need to offer deliberation to the mathematical content and the level at which the children are working.

Anghileri (2000) noted that this control encourages flexibility of thinking and mental fluency. The more effective, games encourage mental work as calculations are tackled in children's heads. As much as possible, children should be encouraged to discuss mathematics inherent in the game, and the strategy employed, in order to help the development of mathematical language skills.

The study in agreement with Parr (1994), Anghileri (2000) and Farant (1997) asserts that games arouses children's interest as they are guided from one step to another and the method is hailed for its quality of posting a clear picture of a given concept and helps to develop interactive skills. In concurrent with Jean Piaget (1952) and Integrationists theorists the study also noted that children learn best, and construct knowledge through doing and active participation through methods as games. The study evidently revealed that Games among other interactive methods such as Self Directed, Discussion were more linked to above average achievement. It was noted that teachers who used the interactive methods tied with doings and oiled by adequate teacher learner interaction created high achievement.

## **2.5 Self Directed**

Self directed learning gives control and responsibility for teaching to the learner (Petty, 2001). Petty (2001) noted that this method is a humanistic approach in which the teacher takes on facilitating role. He also indicates that this learning involves these three conditions: wants or at least to be prepared to accept the degree of independence given, have or been quickly developing skills or attitude to manage the independence, and learn reasonably effectively with autonomy given.

In Self Directed Learning, learners are owners and managers of their own learning process. Learners integrate self management with self monitoring. This is supported by Garrison (1997) who asserts that self directed learners demonstrate greater awareness of their responsibility in making learning meaningful and monitoring their activities. They are curious and willing to try new things (Layman, 1997), view problems as challenges, desire change, and enjoy teaching (Taylor, 1995). Taylor also found them to be motivated and persistent, independent, self disciplined, self confident and goal oriented.

The study found out that the teachers should raise children awareness of their roles in learning in pre-schools. This is in agreement with Taylor (1995) suggesting that children be engaged in discussion on mathematical activities from Self Directed Readiness Scale. The idea was also supported by Layman (1997) suggesting generating similar discussion through the use of questions designed to help learners become aware of what good mathematic learners do and how to become one . Bolhuis (1996) stress that teachers who want to encourage self directed learning must free themselves from a preoccupation noted that it allows learners to be more effective learners and social beings. Guthrie,

(1997) noted that the self-directed learners have the ability to search for information in multiple texts, employ different strategies to achieve goals and represent ideas in different forms. Morrow, 1993 observed that with proper planning and implementation self- directed learning can encourage pupils to develop their own rules and leadership pattern

The study in harmony with Garrison (1997) noted that Self Directed learning makes learners become managers of their own learning and self monitors of their own activities. This was clearly portrayed in the results of the exams administered by the learners who were practicing the method scoring above average marks.

## **2.6 Achievement in Mathematics**

According to NACECE (2002) the training teachers themselves have received affects the way in which pre-school children are taught and learn, and that include mathematics achievement. Trained teachers have learned skills that enable them to relate well with children, parents, community, and committees. They have also learned to make good use of learning resources and materials, as well as guiding children better, and stimulating them in learning, so resulting in a better academic achievement by their learners. Teacher training is needed after a person has achieved academic qualifications, which are a prerequisite to ensure a teacher's competency.

When a preschool child has been taught by a qualified and competent teacher, it is likely that such a child will be more likely to benefit from subsequent education than one who hasn't received preschool teaching. In stating the need to evaluate when a child have

received good teaching, MOEST (2000) defined evaluation as a systematic of method of determining the success of the best objectives of pre-school education. It gave direction on the way forward for the achievement of the intended results. Purposeful evaluation should be considered in order to determine efficiency, effectiveness, impact, sustainability and relevance of the set objectives for the successful running of pre-school programs. Assessment of the successful impact of an agreed plan of children's learning and achievement should be done, in order to determine such matters as mathematical skills and a child's readiness for lower primary education.

The study noted that different methods used in mathematics instruction register different achievements, this is in agreement with Brown and Atkins, 1988 asserting that bad teaching occurs when one uses inappropriate methods and results to reduced motivation, increases negative attitudes to learning and yields to lower achievements. Keith 1997 also concurred with them noting that the method used in teaching mathematics is instrumental in determining ones achievement. The study observed that teachers who used non interactive methods such as lecture, drill and practice method had their classes score below average mean and teachers who used interactive methods such as demonstration practical work/pupils experiments, demonstration play, small group discussion, games and self-directed methods, were more linked to above average achievement.

## **2.7 Theoretical Framework**

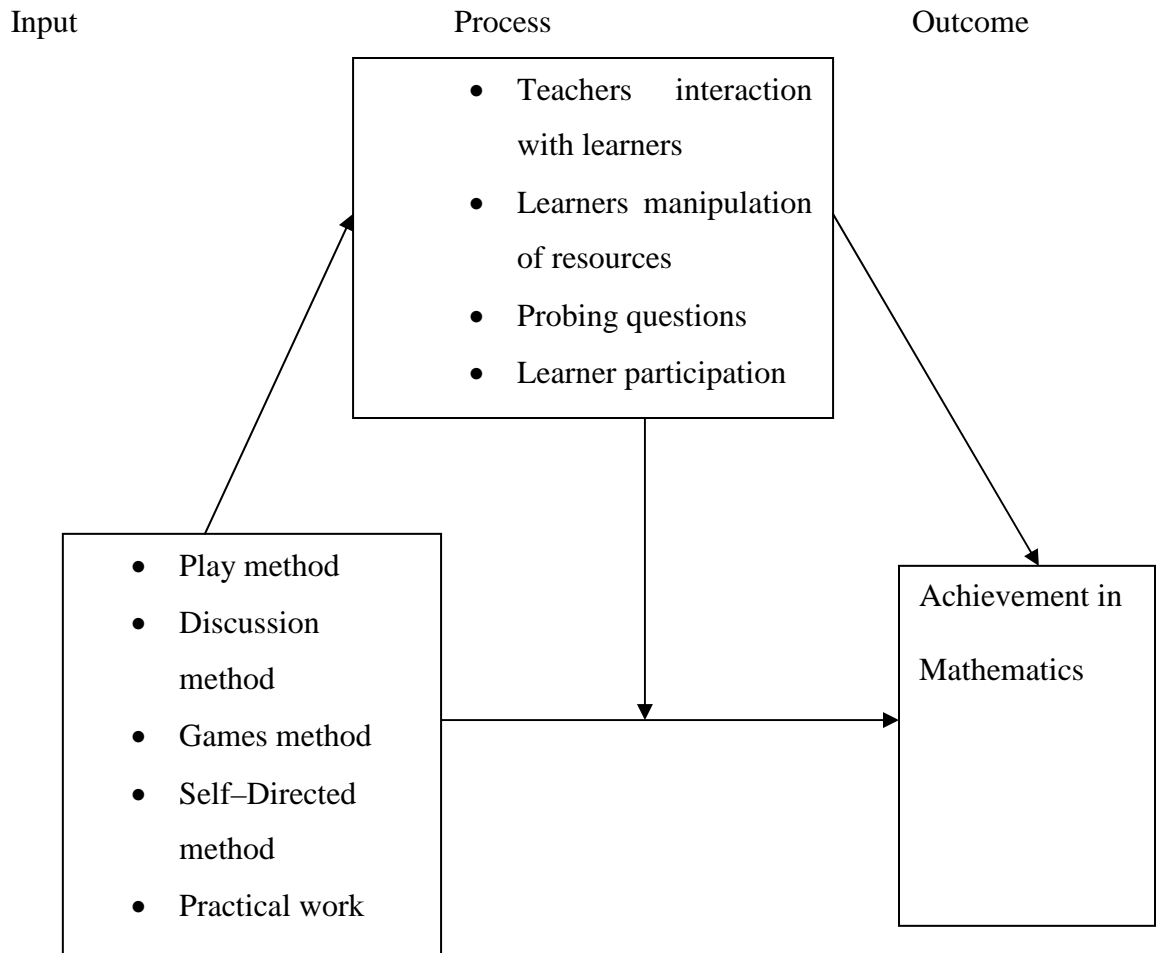
This study was based on the theory of constructivism as put forward by Piaget (1896-1980) and Vygotsky (1896-1934). Constructivism refers to an approach to learning that highlights that individuals learn well when they actively construct knowledge and understanding. This theory highlights that teachers should offer support for pupils to discover and build up understanding and create many opportunities for pupils to learn with the teacher and with peers in constructing knowledge. Piaget and Vygotsky emphasize that teachers should serve as facilitators and guides rather than directors and molders of children's learning. The following are the constructivist's principles essential in the teaching of mathematics; making mathematics rational and fascinating, considering pupils' prior knowledge, making mathematics curricula socially interactive and pioneering mathematics projects (Santrock 2004).

Bruner's (1961) constructivist theory suggests it is successful when faced with new material to follow a progression from enactive to iconic to symbolic representation, this holds true even for adult learners. A true instructional designer, Bruner's work also advocates that a learner even of a very young age is competent of learning any material so long as the teaching is organized appropriately, in sharp contrast to the beliefs of Piaget and other stage theorists. Bruner (1961) proposes that learners construct their own knowledge and do this by organizing and categorizing information using a coding system. Bruner believes that the most effective way to develop a coding system is to discover it rather than being told it by the teacher. The notion of interactive learning implies that children create their own knowledge for themselves. Bruner, like Vygotsky, emphasized the social nature of learning, citing that other people should help a child

develop skills through the process of scaffolding. Like Piaget, Vygotsky believes that young children are curious and actively concerned in their own learning and discovery and development of new understandings. However, Vygotsky sited more prominence on social contributions to the process of development, whereas Piaget emphasized self instigated discovery

Mac Nally (1973) supported Piaget's views of spontaneous development impact on how the children learn about themselves and the environment as they use practical experiment. In support of Piaget, Dewey (1952) affirms that to achieve self discovery peer interaction, experience sharing, the teacher should provide the child with the opportunities for exploration, knowledge, construction, interactive and critical thinking. Teaching under constructivist environment considers the learner to be engaged in a model construction process where prior knowledge is activated, criticized and modified by the learner in order to form new knowledge structure. This calls for the teacher to use instructional methods which initiates set of teaching approaches, practices, techniques/ procedures, routines and rules in an attempt to facilitate learning (Curzon, 1990) .

## 2.8 Conceptual Framework



**Figure 1: Conceptual framework of the Study**

The above figure indicates that interactive teaching method adopted by a teacher in teaching mathematics is related to learner's involvement and participation. The study was aimed at establishing to what extent these teaching methods influence achievement depending on the method's nature of involving activity, transfer and retention ability. We have different methods and all vary in level of learner involvement. Depending on the way a teacher handles the method he /she opts to use, learners perceived the methods differently.



## **CHAPTER THREE: RESEARCH METHODOLOGY**

### **3.1 Introduction**

This section describes the design of the study, the target population, sample and sampling procedures, research instruments, and data collection procedures.

### **3.2 Research Design**

The study was conducted using ex-post facto research design. An ex- post facto research design examines variables in retrospect. According to Tuckman (1978), an ex-post facto research design is one in which the investigator examines the variables without manipulating them. The researcher tried to establish that which had already taken place after the variables had already worked or caused an effect on the dependent variable. The design was found suitable because the variables involved in the study, that was, teaching methods used in mathematics teaching; Play method, Small-Group Discussion method, Games method, Self- Directed method, and learner's attainment was not to be manipulated. The teaching methods examined were those that the teachers had been using in the three years course.

### **3.3 Target Population**

Mugenda (1999) defines population as an entire group of individuals, events or objects having a common observable characteristic. The target population in the study comprised of all children and teachers in public preschool education in Nyang'oma zone, Muhoroni District. The targeted population is 18 preschools, 720 children and 54 preschool teachers. The teachers were in a position to indicate the teaching methods

each of them employ very often, reasons for using the methods, and were in a place of candidly evaluating the school in terms of learners participation of the methods used.

### **3.4 Sample and Sampling Procedures**

Best and Kahn (1998) defines sample as a small proportion of a population selected for observation and analysis, while sampling is defined as a deliberate rather than haphazard method of selecting subjects for observation, to enable scientists to infer conclusions about a population. The study used two sampling methods; purposive sampling and simple random sampling. This enabled the study to capture all the schools characteristics. This ensured that each school contributed in the finding.

Simple random sampling was used to select the desired representation of 8 preschools (45%) from the 18 preschools in the zone. Simple random sampling gives every subject an equal chance of being selected (Mugenda & Mugenda, 1999). From the sampled schools, purposive sampling was used to select 20 preschool pupils from each school in their final class giving a total of 160 pupils. One teacher per school teaching mathematics in the final class was randomly selected to participate in the study. This number was relatively large to ensure that the sample was a representative of the population and to reduce the magnitude of sampling error. Best and Kahn (1998) assert that the larger the sample, the smaller the magnitude of sampling error and the greater it is that the sample is a representative of the population.

### **3.5 Data Collection Instruments**

Data collecting instruments are used in securing information concerning phenomena under study from a selected number of respondent's (Mulusa 1988). The following instruments were used to collect data for this study: Questionnaires, Interview schedule, Documentary analysis, and observation checklists

#### **3.5.1 Questionnaires**

The questionnaires used in this study were for teachers because they were literate and capable of answering questionnaire items adequately. Questionnaires' as tools of research are widely used in educational studies to get information about current conditions, practices, attitudes, and opinions in a quick and precious manner. It allows data collection from large samples of preschool teachers in different regions, in a confidential quick and non bias manner regarding the children's contribution, and involvement in mathematics activities. Open and closed ended questions were ultimate. Closed ended questions were used to obtain both personal and specific details from respondents while open ended questions were used to where explanation and personal opinion was being sought.

The questionnaires were administered by the researcher. The usage was paramount because they are time saving and straight forward for the respondents. Ogula (1998) observes that questionnaires are appropriate for educational research since they are less costly and use less time as instrument of data collection.

### **3.5.2 Interview Schedule**

An interview schedule, involves presentation of oral verbal incentive, and responds in terms of oral-verbal reactions (Kothari, 2000). It makes it possible to acquire data mandated to meet specific objectives of the study, allows consistency of questions and collection that cannot be directly observed or is difficult to put in writing such as historical information. Besides, it enabled researcher to gain control over the line of questioning, provides high reliability of the information gathered, and is systematic, time saving and comprehensive. The instrument with relevant questions was prepared and administered to individual teachers who were having capacity to provide for preschool education, involvement and participation levels in preschool education, dares and outcomes on child's success in preschool.

### **3.5.3 Documentary Analysis**

Documentary analysis was expedient for the study as it gives legitimate information without withholding information required. It facilitated the researcher to acquire information regarding teacher's preparation records like; schemes of work, lessons plan, pupils progress record, class register and various class activities done by children, more so in number work. It was used to reveal the teaching methods applied in teaching / learning mathematics and the achievement of learners by observing progress records, and learner's exercise books.

The usage of documentary analysis was significant as the researcher attained data at convenient and it saved time .Nevertheless, the researcher did not have power over the respondents as he relied on documented information.

### **3.5.4 Observation Checklists**

This is a form in which observation of an object or a phenomenon is recorded. The purpose was to check: teacher participation, classroom management and the mathematics learning corners. The researcher recorded evidence or observed phenomenon by placing a check in the appropriate column and comments written down in the section following each checklist.

### **3.5.5 Pre-Testing of Research Instruments**

Piloting was done in two pre-schools with two teachers on the basis of ability to generalize data. The significance of pre-testing was to assess validity and reliability of each of the items in the questionnaire and the suitability of the language used in the instrument (Mulusa, 1988). Drafted items were piloted in order to avoid threats to reliability, revealing vague questions and unclear instructions.

### **3.6 Validity of Instruments**

According to Mulusa (1988) a test or research instrument is said to be valid if it measures what it is believed to measure. Cronbach suggests that the validity of an instrument may be recognized deductively by showing that the items match up to the definition of the trait anticipated to be measured. For the validity of any measuring instrument to be qualified, it must be subjected to a pre-test (Cronbach, 1982; Mugenda and Mugenda, 1999). Thus the questionnaire was pretested before the research commenced to check, correct and assess their content and construct validity. This made possible the researcher to assess whether the respondents understood the questions or

not and whether the questionnaires enabled the research to realize the objective of the study.

### **3.7 The Reliability of the Instruments**

Mugenda and Mugenda (1999), define reliability as a measure of the degree to which a research instrument yields consistent results or data after repeated trials. Reliability in research is influenced by random error. Random error is the deviation from a true measurement due to factors that have not been effectively addressed by the study. According to Mulusa (1988), reliability of an instrument is increased by precise identification of data required, repeated review of instruments by knowledgeable researchers and field test on appropriate population. Foremost, the researcher required the expertise of his supervisor before getting on data collection process. The supervisor comprehensively went through the questionnaires, recognized the areas missing out for inclusion, and identified those that needed to be struck out. Secondly, the study administered the instruments to a small sample of population. The responses from each design were added and the average score obtained. The average score for all items exceeded 85 percent and therefore the instruments were said to be dependable and thus used to seek for desired information.

### **3.8 Data Collection Procedures**

The researcher wrote a letter of transmittal to the school heads. The letters were then sent to the head teachers of the participating schools after which the schools were visited for the administration of the questionnaire. Before presenting the instruments to the subject study, the researcher first did the pretest to some teachers and a few children. In

the field the researcher introduced and explained himself. The reception from the interviewees was warm and they were ready for the interview. The interviewees preferred to go through the questionnaires of which the researcher gave time to do so. Few teachers went through the questionnaires and answered immediately but the majority requested for some time of which was accepted.

Lastly, the researcher collected and assembled all the data, sorted and read through all of them. Every questionnaire was analyzed by the researcher. Due to the nature of the study, findings from the observation and the administered test were analyzed qualitatively. Thus the procedure for data collection conducted allowed a thorough analysis of finding out the influence of interactive teaching methods on achievement in mathematics among preschool children in Nyang'oma Zone of Muhoroni District.

### **3.9 Data Analysis Techniques**

There was edition to assure exactness and consistency of the information contained in records, and was helpful in ensuring that all desired information was conceptualized, coded and verified to reduce possibility of disparity between available information and what was projected to be captured as per research questions (Kombo and Tromp 2006). After information screening, arrangement of data collected was done, to ensure logical ordering, linking ideas and grouping of logical information.

Quantitative data analysis involved the use of Statistical Package for Social Science (SPSS). SPSS is recognized for its ability to process large amounts of data given its broad spectrum of statistical procedure which was resolutely designed for social

sciences. With this the researcher gathered all the instruments, for data coding and subsequent analysis. Simple descriptive statistics such as frequencies and percentages were used because they can easily be interpreted by many people. For any item in the questionnaire, responses was coded in a tally sheet, the percentages were calculated from frequencies obtained. Information obtained from documentary analysis was compared against findings from the observation checklist and questionnaires. The results recorded in the tables showing the frequencies and percentages, the coded data and the quantitative data were then analyzed using descriptive statistics. The statistics calculated were frequencies, mean, and percentages. The results of the analysis are discussed in the preceding chapter.

### **3.10 Ethical Consideration**

According to Mugenda (1999), ethical deliberations are important for any research. In this study, the research ethics was appraised by an Ethics Board to establish ethical guidelines for conducting the research so that ethical values are not dishonored. Such matters included proper conduct of the researcher during the research process, evasion of plagiarism and deception, confidentiality and privacy of the information obtained from the respondents, avoidance of physical and psychological harm to the respondents (particularly that the study was contracting with minors), acquiring deliberate and informed consent from the respondents and publicization of the findings, these values were strictly adhered to.



## **CHAPTER FOUR: DATA ANALYSIS AND INTERPRETATION**

### **4.1 Introduction**

This chapter represents analysis and interpretation of data collected, with the aim of instituting the level to which teaching methods used by Mathematics teachers influence learners' achievement in Nyang'oma zone, Muhoroni District. The investigator developed questionnaires for mathematics teachers to enable him in coming up with wholesome data, thus allowing a holistic view of the methods used. The researcher administered the research instruments to the sampled teachers. The chapter thus presents the findings, beginning with the demographic and other general information on the teachers and schools that participated from the study. Secondly, a presentation of the methods used by mathematics teachers is given. This is followed by a presentation of the participation of the children on the various teaching methods. The findings on what determines the method used by mathematics teachers are discussed. Finally, the methods used by mathematics teachers are discussed in reflection to learners' achievement.

### **4.2 Questionnaires Return Rate by Teachers**

The researcher had developed questionnaires for ECDE teachers. 8 teachers had been sampled out of the total 18 teachers, and 160 children had been sampled out of 810 children in the zone. Out of the 8 sampled teachers, 7 returned their questionnaires. This represents 87.5% return rate. A possible reason for the unreturned questionnaire may have been the timing of the study. Teachers were busy preparing children for end of the year exams. The researcher managed to reach 7 units drawn from 18 schools with a total of 140 children.

### 4.3 Teachers' Demographic Information from the Questionnaires

The ECDE teachers were requested to give information concerning their gender, age, highest level of academic and professional achievement, teaching experience in the teaching subject and the number of lessons they handle in a week.

Data on teachers' gender from the questionnaires is as shown in table 4.1.

**Table 4.1: Mathematics teachers' gender in Nyang'oma zone**

Gender	Frequency	Percentage
Female	7	100.0
Male	-	-
Total	7	100.0

The study targeted 7 teachers who responded to the questionnaire. It was observed that the sampled population of mathematics teachers in Nyang'oma zone were females (100%), compared to male (0%). This indicates that the female mathematic teachers dominated the zone. This situation is a contradiction of an outcry echoed for years that mathematics and sciences are male related, whereas humanities, languages and other social sciences are viewed female related.

The data on teachers' age is as shown on table 4.2.

**Table 4.2: Mathematics teachers' age in Nyang'oma zone**

Age(in years)	Frequency	Percentage	Cumulative %
30	4	57.1	57.1
30 x 40	3	42.9	100.0
40 x 50	–	–	–
<b>50</b>	–	–	–
<b>Total</b>	<b>7</b>	<b>100.0</b>	

Table 4.2 indicates that all the teachers observed, that is, a total of 100% are 40 years and below. Table 4.3 shows the teachers' highest academic qualifications.

**Table 4.3: Teachers' highest academic qualifications**

Academic qualification	Frequency	Percentage	Cumulative %
Bachelors degree	–	–	–
Form four	7	100.0	100.0
Std Eight	–	–	–
<b>Total</b>	<b>7</b>	<b>100.0</b>	

The table shows that 100 percent of mathematics teachers in Nyang'oma zone are form four graduates.

Table 4.4 indicates mathematics teachers' highest professional qualifications.

**Table 4.4: Mathematics teachers' highest professional qualifications**

<b>Professional qualification</b>	<b>Frequency</b>	<b>Percentages</b>	<b>Cumulative %</b>
Bachelors degree	–	–	–
Diploma in education	1	14.3	14.3
Preschool certificate	5	71.4	85.7
In- service course	1	14.3	100.0
<b>Total</b>	<b>7</b>	<b>100.0</b>	

Table 4.4 shows that about 85.7 percent of mathematics teachers are professionally equipped to teach. 14.3 percent of the teachers are diploma holders, meaning that less than a quarter of the teachers are diploma graduates 71.4 percent are certificate holders and another 14.3 percent have attended in service course. There is an indication that one of the challenges in teaching mathematics is shortage of qualified mathematics teachers. Many teachers teach mathematics with little knowledge about the subject or about the current ideas of teaching it. Information on the quantity of experience in the teaching profession and in the teaching of mathematics in particular, was sought from the teachers.

Table 4.5 shows the summary of the results.

**Table 4.5 Teaching experience of mathematics teachers in Nyang’oma zone**

Experiences(in years)	Frequency	Percentage	Cumulative %
1-5	3	42.9	42.9
6-10	4	57.1	100.0
11-15	–	–	–
16-20	–	–	–
<b>Total</b>	<b>7</b>	<b>100.0</b>	

From the table, it is evident that a sizeable number of teachers, 42.9 percent had teaching experience of between 1 and 5 years. It is also observed that a total of 100 percent of mathematics teachers had a teaching experience of between 1 and 10 years. It is thus noted that the majority of teachers were fairly young in the profession. Further, it was noted that these teachers were not only young in the profession but all of them (100%) were aged 40 years and below as reflected in table 4.3.

Gumo (2003) and Otieno (1980) affirms that a teacher’s past experience acts as the sharpener for better understanding of subject to be learnt as one is able to transmit new concepts to similar ones learnt earlier. In this case there is verification that there is high level of number work acquisition skills among pre-school children due to many years of experience among pre-school teachers.

#### 4.4 Effects of Interactive Methods

A description of the findings on the methods used by teachers in special reference to the children's average achievement is provided. This is followed by the findings on possible relationship between the aspect of learner's involvement and participation in the mathematics teaching method used on learners' achievement index. For scoring purposes, the study used the "often" and the "very often" columns as scored by mathematics teacher's questionnaires.

Table 4.6 gives a summary of the (administered exam) achievement for the Pre-Unit Class against the methods of teaching for the sampled schools.

**Table 4.6: Effects of teaching methods and achievement**

Methods	Achievement							
	Below Average		Average		Above Average		Total	
	Freq	%	Freq	%	Freq	%	Freq	%
Lecture method	1	100.0	-	-	-	-	1	100.0
Self-Directed/Textbook reading	1	100.0	-	-	-	-	1	100.0
Drill and Practice	1	20.0	2	40.0	2	40.0	5	100.0
Demonstration	3	42.9	2	28.6	2	28.6	7	100.0
Homework/Assign	2	40.0	2	40.0	1	20.0	5	100.0
Small group discussion	1	20.0	2	40.0	2	40.0	5	100.0
Games	1	16.7	2	33.3	3	50.0	6	100.0
Play	2	28.6	3	43.9	2	28.6	7	100.0
Narrative/Storytelling	1	14.3	3	42.9	3	42.9	7	100.0

Table 4.6 gives a breakdown of achievement of children in relation to the various methods used by their teachers. It is observable that only one teacher out of seven teachers who used Lecture and Self-directed/Textbook reading had their classes in the below average category.

According to Bersonondyal Fischer and Raymond (2005), children's engagement is a complex concept that includes the scores of internal and external factors. Jerald (2002) seemed to be in agreement with Bersonondyal as he states that the methodology of teaching is of importance if the children have to achieve higher academic standards. Bersonondyal also states that traditional way of teaching mathematics is lecturing where children memorizes procedures and formulae. Lecture often becomes the method of choice in mathematics because it allows the coverage of the syllabus in terms of content (Oyaya & Njuguna, 1999).

The study noted that lecture method had glaring weaknesses in that there was little or no learning participation. The children had low grasping ability and thus would become bored if the teacher went on pumping knowledge, hence poor achievement since they didn't require much contact time with their teachers'.

Drill and practice method, is a behaviorist aligned technique in which learners are given the same materials repeatedly until mastery is achieved. In, each iteration, children are given similar questions to answer or activities to perform, with a certain percentage of correct responses or actions moving the children to the next level of difficulty. This technique is taken by the teacher after the official teaching has taken place usually at the

end of the topic or term by giving selected extra problems (Mutunga and Breakell, 1992) Drill periods, Butter and Wren (1960) asserted that any subject matter however well taught is likely to be forgotten, no matter how well it has been initially mastered, unless it's maintained by repeated application or practices. He indicates the term drill replaces all situations with recurring experiences and hence the drill discussion is all about teaching for permanence. This incorporates new terms like review, 'maintenance' and 'practice' (Butter and Wren, 1960).

The study observed that in the schools where teachers were using Drill and Practice method the achievement was poor, this is in agreement with Butter and Wren (1960) that even if the subject matter is well taught, learners tend to forget very quickly.

Demonstration and small group discussion all seemed to have children's fairly spread over the three categories achievement .In harmony with the literature review and Marlene (1985), the study observed that demonstration teaching method is effective because children not only hear, but see how to do something and can then easily try it themselves In agreement with the literature review, the study noted that, Group Discussion promotes interaction amongst preschoolers' and encourages constructive competition. It is important to note that all the pre- unit classes which obtained average scores had used these methods.

Majority of teachers who used games, play, and other experiential methods had their classes score above average. This could be attributed to the ability of the methods to



create interest as learners learn by getting involved. This support the fact that by doing, learners will have their understanding and retention abilities increased.

According to the study, Brown and Atkins (1988) is in agreement with the findings as they assert that there is close relationship existing between mathematics teaching methods and achievement and that the method used in teaching mathematics is instrumental in determining ones achievement. This is supported by Edger (1994) indicating that people have adopted many different methods in an attempt to improve teaching of the “telling” type. Edger asserts that the methods have tended to vary according to fashion and the current state of technology.

From the literature and analysis made it reveals that learners taught by interactive methods performed better than those taught by other methods. The findings further shows that learner’s achievement depends upon the selected methods of teaching in preschools. This is in agreement with the works of Mukwa and Too (2001) who asserted that methods of teachings used at all levels of learning have varied influence on achievement.

#### **4.5 Effects of Teaching Method Used and Learner’s Participation**

The nine mathematics teaching methods were categorized as done earlier , giving rise to these groups: ‘least learner interaction’, ‘average learner interaction with activity’ methods and ‘activity interactive’ methods, whereas the categories adopted for the children achievement indices were the ‘below average’, ‘average’ and ‘above average’. The study thus set to identify whether there was a significant relationship between the

kind of method used by a teacher and the respective children's achievement. Following is an analysis of the findings.

**Table 4.7: Effects of teaching method used and learner's participation**

Achievement	Level of interaction/Participation							
	Least		Average		High		Total	
	Freq	%	Freq	%	Freq	%	Freq	%
Below average	2	66.7	1	33.3	-	-	3	42.9
Average	1	50.0	-	-	1	50.0	2	28.6
Above average	-	-	1	50.0	1	50.0	2	28.6
Total	3	42.9	2	28.6	2	28.6	7	100.0

From the table, it is significant to note that the teachers who used methods with minimal teacher- learner interaction, with learners doing little or nothing had their children's post poor grades, and teachers who used interactive teaching activities scored above average achievement. This is also portrayed in table 4.8. A possible explanation for this observation is as attested by the teachers themselves in an earlier discussion that the ability of a method to captivate children's varies as children's achievement. These methods do also deny learners important chances of clarification given that some mathematical ideas are hard to conceptualize.

**Table 4.8 Nyang’oma Zone pre-unit class mathematics means score (2013)**

Method	No of Pupils	Total Marks	Mean Score
Interactive	80	4912	61.4
Non- Interactive	60	2832	47.2

From the study it is noted that teachers who used methods involving interactive activities and energized by adequate teacher-learner interaction produced satisfactory achievement. A possible explanation for this is as asserted by the two thousand year old Chinese proverb “I am told, I forget. I see, I remember. I do and understand” (Petty G, 2001). Though the methods were noted to take a lot of teacher’s time in preparation as well as calling or high-level skills in implementation, the methods were noted as having an edge over others in stimulating interest. Children’s responses revealed that these methods created chances for deeper understanding as they would involve the senses of touch, feel, smell, hearing and sight in manipulating objects, learners would be attentive, and this would enhance retention. In agreement Piaget (1950), Dewey (1952) affirms that to achieve self interactive, peer interaction, experience sharing, the teacher should provide the child with the opportunities for exploration, knowledge, construction, interactive and critical thinking. Teaching under constructivist environment considers the learner to be engaged in a model construction process where prior knowledge is activated, criticized and modified by the learner in order to form new knowledge structure.

Examining the literature as in agreement with Bruner (1965) reveals that learners are involved in retrieval of information, understanding it by integrating it with the existing knowledge they have had by arrangement of the new knowledge, they are able to produce a new or a desired learning. The participation of the learners in mathematical activities has an influence on the achievement in mathematics.

#### **4.6 Teaching Methods in Relation to Workload**

Teaching method classification was adopted in line with Moya O's observation that a teaching method should be judged depending on how it involves the learner in doing (1988). The first three methods, that is, lecture, self directed instruction and drill and practice were then lumped together giving rise to the least teacher-learner instruction category. The second category included those methods that had average interaction and activity between the learners. Demonstration, homework assignment and small group discussion methods were lumped together to give rise to 'average teacher-learner interaction with activity'. The other three were lumped together and referred to as 'activity interactive methods'. In using methods in this last category, it was noted that learners were required to participate in activities that would hasten learning mainly through discovery. Here in case a teacher ticked the use of more than one method, then the researcher entered the category in which more of the methods ticked in the very often column lie. Only the 'very often' response was involved in the discussion since the aim was to determine the relationship between workload and the level of activity of the method used. The study thus set to establish whether there was significant relationship between load and the level of activity in the method used by a teacher.

The mathematics methods of instruction within the categories of least teacher-learner interaction, average, and high discovery methods were cross tabularized against the classified data on the number of lessons teachers taught in a week as shown in the eventuality table 4.9

The findings as per category are as reported in table 4.9.

**Table 4.9: Effects of teaching method, and teachers' workload**

Workload	Level of teacher-learner interaction and activity							
	Least		Average		High		Total	
	Freq	%	Freq	%	Freq	%	Freq	%
12-16	-	-	-	-	1	14.3	1	14.3
17-21	-	-	1	14.3	1	14.3	2	28.6
22-26	2	28.6	1	14.3	-	-	3	42.9
27-31	1	14.3	-	-	-	-	1	14.3
Total	3	42.9	2	28.6	2	28.6	7	100.0

In the study, the larger percent of those who use activity interactive methods teach fewer lessons per week. The bulk of the teachers who involve the methods that attract low teacher-learner interaction and least active methods teach more lessons per week.

In the study, it is very clear that the biggest percentage of those who use activity interactive methods teach fewer lessons per week. The bulk of the teachers who involve

methods that attract low teacher-learner interaction and least active methods teach more lessons per week. The study findings noted that different methods require different periods of preparation. Methods that invoke little feedback from learners normally require little preparation. Petty G (2001) in an agreement observed that games and other active learning techniques indicated that teachers need ample time to at least prepare materials intended to invoke experiences. The workability of interactive method includes a good plan in advance and effective trial. A teacher with relatively more lessons to teach in a week has comparatively less time to plan. The study observed that if teachers were given more time, then they would create more opportunities for learners. More particularly they would ‘plan/carry out and consider exploratory sensible work.’

The literature review, in agreement with Barnes and Coupland (1990) asserts that teachers are aware of teaching and learning strategies which are effective in the achievement of learners in mathematics but do not utilize them because of the volume of work to be covered to complete the syllabus in time. This prompts the teachers to forsake the admittedly more time consuming activity learning styles to largely less ones in retaining information.

#### **4.7 Effects of Teaching Experience and Teaching Method Used**

Data on mathematics teacher’s experience used was as represented in table 4.5. Although the correlation between the two variables is slight, it was noted that the more the number of years a teacher has in the profession, the more he involves the learners in activity methods. The finding that the use of Activity Interactive methods varies with

experience supports the observation by Sidhu,(1982) that with increase with time in the teaching career, some 'credible characteristics such as celerity, flexibility, efficiency, the ability of arousing and maintaining interest, adequate command of instructional material are infused into the teachers.

It is proper for one to say that experience goes with amplified ability to teach. Teachers who are presently new in the profession were found to use more of methods that call learners to play an inactive role. Bulks of teachers who are comparably old in the line of work were observed to use methods that occupied the learner in some doing.

In the literature, in agreement with Sidhu (1982) it is noted that successful teaching experience empower teachers with efficiency, command of instructional material and better methods of teaching. There is also a relationship between the teachers experience and the method used. It is observed that teachers with high teaching experience choose methods that have more activities involving interactive in learning. This enhances the achievement of preschool children in mathematics activities.

## **CHAPTER FIVE: CONCLUSIONS AND RECOMMENDATIONS**

### **5.1 Introduction**

This chapter provides the conclusions arrived at as deduced from the findings, and recommendation for the possible action and for further research.

### **5.2 Conclusion**

When drawing the conclusion, it was noted that the most used teaching methods in mathematics instruction includes, Demonstration, Homework/Assignment, Small Group Discussion, Games, and Play. These methods were used by more than half of the mathematics teachers. It was noted that these methods involve considerate learner activities. The methods also call for considerable teacher- learner interaction. The methods are key components of mathematics lesson in Early Childhood Education.

Self- Directed method and Lecture method were employed but by the least number of mathematics teachers. Although Self- Directed method allowed autonomy, many teachers found fault in it mainly because not many children's in ECDE had the ability to synthesize ideas and understand them fully on their own. Lecture method was found to deny adequate teacher- learner interaction. Learning of the method was content driven and teachers- learner interaction was minimal. These arguments contributed to the two methods being unpopular.

With regard to learner's participation on the various teaching methods, it was noted that Demonstration method, Homework/Assignment method, Small Group Discussion method, Games methods, and Play methods were the most liked in delivering



mathematics concepts. Although many factors like teacher factors, and content method congruence were noted to play part in the methods liking, it was observed that all these methods needed considerable involvement of the teacher in preparation and delivery. All these methods had activities both for teachers and children's. If used well, all these methods have an element of interactive on the part of children's, indicating that learners were taken through various levels of understanding sequentially.

Comparing the methods most preferred and mathematics grade attained, revealed that Discussion method, Play method, and Self- Directed method were most preferred by above average children's. The methods used in mathematics instruction and preferred by below average performers included Narrative/Storytelling method, Lecture method and Homework/Assignment method.

With respect to the main teaching methods, the study found that a teacher's weekly number of lessons determined the kind of method he/ she used. It was observed that the more the number of lessons a teacher had, the less time he/ she had to plan and the less of the activities he/ she can plan. Teacher- Learner interaction was also minimal if one had many lessons. Indeed it was felt that less workload would provide more opportunities for children's learning.

The study has also established that there is a significant relationship between a teachers' experience in teaching mathematics and the level of teacher- learner interaction allowed by the method he / she chooses as well as the level of hand on activities with the method. Teachers with vast experiences were found to adopt methods that involve

interactive and that are activity oriented. Teachers with a considerably short experience mainly involved passive participation by learners.

It was established that Demonstration method, Homework/Assignment method were all linked to average achievement while Games method, Play method, and Small Group Discussion method were more linked to above average achievement. This meant that increased use of the methods would improve learners' achievement

The study established that a relationship exists between the nature of the teaching method adopted by a mathematics teacher in terms of learner participation and teachers-learner interaction and the achievement posted. The study found that teachers who used methods involving interactive coupled with activity and fuelled by adequate teacher-learner interaction produced satisfactory results. These methods are all costly but effective

### **5.3 Recommendations**

From the findings of the study the following recommendations were made:

A child's entry conduct in particular his/ her achievement in course group may imply the methods of mathematics instruction he/ she prefers. The study found out that above average children's prefer Play method, Demonstration, Small Group Discussion method, and Self Directed method. Low achievers were recognized with Lecture method, and Narrative/Storytelling method. It is consequently recommended that administrators in preschools advocate for use of these methods in their schools depending on the ability of learners.

The study found out that the methods of mathematics instruction used was dependent on the weekly number of lessons a teacher had. Teachers with few lessons used methods with more activity and those that allowed high level of teacher-learner interaction and vice versa. The teachers even implied that with more time they would get involved in more activities. The study therefore recommends that more teachers be recruited since this would have a direct impact on children's achievement through a change in teaching methods.

It was observed that a teacher's teaching experience determines the method a teacher adopts through the activity facet and the level of teacher- learner interaction the method attracts. Teachers with high experience are more likely to use active teaching methods` compared to teachers with a few years in the service. Least active methods produce low results geared by low attitude towards the subject. It is noted that most of learners who have low attitude towards mathematics developed this construct in early stages of education. Baby and middle children in preschool education thus form the early years that such participations should be broken. It is therefore recommended that teachers with high experience in mathematics teaching be designated as baby and middle class instructors, this will ensure correction and change of low attitude constructs and learners would start perceiving mathematics positively.

The study administered a uniform assessment test to the ample study stratified along the teaching methods to determine their influence on achievement. The purpose of the test was to ascertain the uniformity of teaching and provide a flat platform for all the learners to find out how they sailed alongside others. From the findings it was found that

schools that employed interactive methods had better achievement as compared to the other methods. The study therefore concluded that interactive methods had greater influence on learner's achievement. Based on this, the study recommends that the stakeholders should develop the ECDE centers in terms of capacity building, to accommodate and promote the use of interactive methods. It further recommends for uniform assessment test at district level as a measure of learners ability on qualification to join standard one. The study established that if teaching methods which are active are used, learning would be fruitful. Therefore teachers are also asked to accept methods that magnetized high level of interaction with the learners. Achievement would be enhanced if methods like games, play and practical methods are used since they are verified to generate good results. In addition teachers are anticipated to make children's part of their teaching to realize good achievement.

It is recommended that In-Service Teacher Education and Training (INSET) programmes be in cooperated so as to augment teacher's competence, more so in teaching methods for the duration of their time of service. Presently SMASSE project is continuing in primary schools and secondary schools in some districts. This project has a visualization of enhancing the potentiality of teachers by trying mathematics teaching methods and approaches in realistic settings and thus developing new ideas and approaches. The study recommends that those funding the project should extend their hands to preschools so as to increase competence in handling the methods used in mathematics instruction.

#### **5.4 Recommendations for Further Research**

The following areas are recommended for further research

The study has investigated the methods used in mathematics instruction .It has also deliberated the children's participations on the methods as used by their teachers. However, it would be useful to compare the most used method with children's general feelings towards mathematics.

The study observed that a teacher's regularity in using a teaching method is in some measure dependent on appreciative of the method as she / he got familiar in college. Advance research could be performed on experiences of teaching methods children's teachers are provided with in teacher training colleges.

This study has recognized that the prevalent limitation in using activity leaning methods is time. A wholesome research could be carried out to verify how long it would take with in progress preschool syllabus to use interactive teaching methods and other active methods of teaching mathematics

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## APPENDICES

### APPENDIX A

#### QUESTIONNAIRE FOR MATHEMATICS TEACHERS

You are kindly requested to complete all the items in the questionnaire by either ticking [√] in the appropriate box or writing the appropriate answers in the spaces provided to reflect your opinion. Your responses will be kept strictly confidential.

##### Section 1

This section seeks information about you and your school. Kindly fill in the space provided or tick [√] the box in front of the alternative response that that relates to you in each of the following items:-

1. School ..... Class.....
2. Gender (a) Male [ ] (b) Female [ ]
3. In which of the following age categories do you fall?
  - a) Less than thirty years [ ] c) 41-50 years [ ]
  - b) 31-40 years [ ] d) Over 50 years [ ]
4. What is your highest level of education?
  - a) Masters degree [ ] c) Form Four [ ]
  - b) Bachelors degree [ ] d) Std Eight [ ]
5. What is your highest level of professional qualification?
  - a) Diploma in Education [ ] c) In-service cause [ ]
  - b) Preschool certificate [ ] d) Any other specify [ ]
6. For how long have you been teaching?
  - a) 1-5 years [ ]
  - b) 6-10 years [ ]

- c) 11-15 years [ ]
  - d) 16-20 years [ ]
  - e) 21-25 years [ ]
  - f) Over 25years [ ]
7. Do you enjoy teaching Mathematics? Yes [ ] No [ ]
8. What is the total children population in your school by gender?
- i. Girls .....
  - ii. Boys .....
  - iii. Total .....
9. What is the number of children in your class?
10. What is your week's total number of lessons?

**Section 2**

1. The following are some methods used by a mathematics teacher in Mathematics teaching. Please indicate those methods that you use.
- Lecture method [ ]
  - Self directed learning/textbook reading [ ]
  - Drill and practice [ ]
  - Demonstration [ ]
  - Homework assignment method [ ]
  - Small group discussion [ ]
  - Games [ ]
  - Play [ ]
  - Narratives/Storytelling [ ]

2. Of the methods you have ticked in the question above, indicate how often you use the methods.

<b>METHOD</b>	Very Often	Often	Rarely	Very Rarely
Lecture method				
Self –directed learning/Textbook reading				
Drill and practice				
Demonstration				
Homework Assignment method				
Small group discussion				
Games				
Play				
Narratives/Storytelling				

3. Give reasons for using the methods you use most often.

Method.	Give reason for the method.



4. Do the children enjoy learning mathematics using the method most often used?  
Yes [ ] No [ ]
5. Comment on the attitude of the majority of your children towards mathematics.....
6. Do you believe there exists a relationship between the teaching method you use and children achievement? Yes [ ] No [ ]
7. Based on your experience over the years, state the teaching methods you think tend to boost children achievement in mathematics.....
8. Assuming more time was allocated to teaching Mathematics, would you anticipate a change in your teaching method? Yes [ ] No [ ]
9. How do you plan for interactive activities e.g. games and projects?  
Very often [ ] Often [ ] Rarely [ ] Very rarely [ ] Not at all [ ]
10. Do you think your teaching load affects the methods you use most frequently?  
Yes [ ] No [ ] Explain.....
11. How often do you use instructional materials/ resources?  
Very often [ ] Often [ ] Rarely [ ] Very rarely [ ] Not at all [ ]  
Explain.....

## APPENDIX B

### LETTER OF TRANSMITTAL

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P.O. Box 92,

**Kikuyu**

**17<sup>th</sup> September 2013.**

The Head teacher,

.....

Dear Sir/Madam,

**Re: PERMISSION TO CARRY OUT RESEARCH IN YOUR SCHOOL:**

I am a master of education (ECE) student in the University of Nairobi. I am carrying out research on “**The Influence of Interactive Teaching Methods on Achievement in Mathematics among Pre-school Children in Nyang’oma zone, Muhoroni District, Kenya**”. To achieve the objective of the study, your institution has been randomly selected to participate in this study.

The questionnaires are designed for this purpose only, hence the responses will be treated with strict **confidentiality**, therefore no name of respondent or that of the school will be required.

Thanks in advance,

Yours faithfully,

Carilus Onyango Agango.

## APPENDIX C

### INTERVIEW SCHEDULE FOR TEACHERS

1. For how long have you been a teacher?  
1-5yrs [ ]    6-10 yrs [ ]    10-20 yrs [ ]    21 yrs and above [ ]
2. How many pupils are in the school? (ECD section)
3. How many teachers are there in school? (ECD section)
4. Is the number of teaching staff in the ECD section adequate?
5. Do you think the time allocated to you for mathematics teaching is adequate?
6. How well have you been to complete the teaching of every topic in mathematics syllabus?
7. What are the possible causes of poor pupil's performance in mathematics in your school?
8. What are the challenges that you experience while teaching mathematics in your school?
9. What methods do you apply in your mathematics teaching?
10. What are the effects of interactive activities on achievement in preschool Mathematics?
11. How do Non- interactive activities influence the achievement in mathematics of preschool children?
12. Do you believe there exists a relationship between the teaching methods you use and children's' achievement?

## APPENDIX D

### DOCUMENTARY ANALYSIS

The researcher accessed the following documents: textbooks, schemes of work, teachers' preparation books, children's progress records, and children's report forms.

- Textbooks: -** To scrutinize the various textbooks used by the schools to ascertain if they contain appropriate mathematics activities for preschoolers.
- Teacher's preparation books: -** To peruse the records to analyze the methods the teachers are using in carrying out mathematics activities in preschool.
- Children's progress records: -** This is to examine performance of pupils in the schools studied against the methods used by the mathematics teachers
- Children's report forms: -** To get the achievement of the learners in mathematics activities at the end of the first and second term.

## DOCUMENTARY ANALYSIS FORM

(To be used by the researcher only)

### Schemes of work

#### (i) Availability

Available  Not available

#### (ii) Relevance

Quite relevance  Relevant  Not relevant

#### (iii) Suitability

Very suitable  Suitable  Not suitable

#### (iv) Objectives

Very well written  Fairly written  Poorly written

#### (v) Practicability

Very practical  Practical  Not practical

#### (vi) Learning activities

Very suitable  Suitable  Not suitable

#### (vii) Teaching activities

Very Appropriate  Appropriate  Not Appropriate

#### (ix) Resources

Varied  Not Varied

#### (x) Period

Enough  Not Enough

#### (xi) Teaching methods

Appropriate  Not appropriate

**(xii) References**

Very relevant [ ] Relevant [ ] Not relevant [ ]

**(xiii) Missing information**

A lot of information [ ] No information [ ]

**(xiv) Does it require improvements?**

Very much [ ] Much [ ] No improvement [ ]

**Lesson Preparations**

**(i) Availability**

Available [ ] Not available [ ]

**(ii) Relevance**

Relevant [ ] Not relevant [ ]

**(Iii) Sequential of lesson steps**

Well sequenced [ ] Not well sequenced [ ]

**(iv) Content**

Very detailed [ ] Detailed [ ] Note detailed [ ]

**(v) Frequency of preparation**

Always [ ] Rarely [ ] Never [ ]

**(vi) Activities**

Varied [ ] Not varied [ ]

**(vii) Time allocation**

Very well allocated [ ] Well allocated [ ] Not allocated ( )

**(viii) Assessment**

Frequently [ ] Sometimes [ ] Rarely [ ]

**(ix) Missing information**

A lot [ ] little [ ] None [ ]

**Progress records**

Progress records

Class----- Age-----

Activity area: Mathematics activities

<b>Name of the child</b>	<b>Sorting and grouping by color</b>	<b>Pairing and matching</b>	<b>Number recognition</b>	<b>Shape recognition</b>	<b>Number identification</b>
<b>M</b>					
<b>N</b>					
<b>O</b>					
<b>P</b>					

**(i) Availability**

Available [ ] Not available [ ]

**(ii) How often used**

Always [ ] Rarely [ ] Never [ ]

**(iii) How it is used**

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-----

**(iv) Composition**

All activity areas [ ] Some activity areas [ ] Very few [ ]

**(v) Criteria used in coming up with it**

Very appropriate [ ]      Appropriate [ ]      Not appropriate [ ]

**(vi) Interpretation**

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**(vii) Progress available**

All children [ ]      A few children [ ]      Very few [ ]

**Lesson Notes**

**(i) Availability**

Available [ ]      Not available [ ]

**(ii) Suitability**

Very much [ ]      Fair [ ]      Poor [ ]

**(iii) Relevance**

Very much [ ]      Much [ ]      Not much [ ]

**(iv) Nature of content**

Very detailed [ ]      Detailed [ ]      Not detailed [ ]

**(v) Consistency in preparation**

Always [ ]      Rarely [ ]      Never [ ]



APPENDIX E

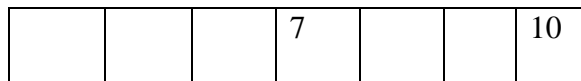
PRE-SCHOOL EXAM 2013 FOR PRE UNIT CLASS MATHEMATICS

Name of school-----

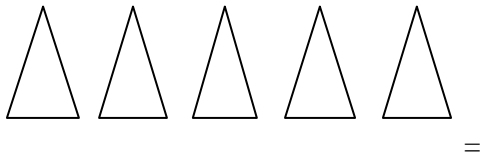
Class-----

Name of pupil-----

(I) Fill in the missing numbers



(2) Count and write how many they are



(3) Add or Subtract

$4 + 3 =$

$5 + \_ = 9$

$2 + 10 =$

$7 - 1 =$

$6 - \_ = 2$

$9 - 9 =$

(4) Arrange the numbers in order; 5, 1, 3, 4, 2

(5) Model numbers (0 ----- 5)