

Impact of Children's Own Investigations on Performance in Pre-School Science Activities in East Division of Isiolo District, Kenya

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DECLARATION

This research project is my original work and has not been presented for award of a degree or a diploma/ in any other Institution/university.

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ACRONYMS/ABBREVIATIONS

| | |
|--------|---|
| ECE | Early Childhood Education |
| ECED | Early Childhood Education and Development |
| EFA | Education for All |
| MOE | Ministry of Education |
| MOEST | Ministry of Education Science and Technology |
| UNICEF | United Nations Children’s Education Fund |
| KIE | Kenya Institute of Education |
| CRC | Convention on Rights of the Child |
| NACECE | National Centre for Early Childhood Education |
| DICECE | District Centers for Early Childhood Education |
| KCPE | Kenya Certificate of Primary Education |
| TIQET | Totally Integrated Quality Education and Training |

ABSTRACT

The purpose of this study was to investigate the impact of Children's own investigations on performance in pre-school science Activities in East Division, Isiolo District. A quasi-experimental research design was used to conduct the study. Ten pre-schools in East Division, Isiolo District, were sampled of which five of them were in the experimental group and five in the control group. All the children, aged 5-6 years, in the experimental and control pre-schools were sampled. Data was collected both in classroom and outdoor learning environments. Pre-school science activities tests were administered to the children. Questionnaires for teachers and head teachers in pre-schools, and observation schedule for class activities were administered. The findings established that the difference in performance between children in the control and those in the experimental groups of pre-schools is statistically significant ($t(8) = -4.463, p=.002$, two tailed). This suggests that children who are taught science activities using traditional methods and children's own investigations perform better than children taught science activities using traditional methods only. The difference in performance was due to treatment or interventions done to the experimental group. Children's own investigations should therefore be used to compliment traditional methods in teaching science activities in pre-schools. The study recommends that pre-school children should be involved in their own investigations in science activities. The Ministry of Education and other stake holders should consider providing adequate resources to pre-schools so that children can be involved in their own investigations in science activities. Pre-school teachers should be trained and provided with pre-school science activities guides so that they can involve children in conducting their own investigations in science activities.

CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

Education is a fundamental right for every person; a key to other human rights; the heart of all development, the prerequisite for equity, diversity and lasting peace (EFA, 2000). Convention on the rights of the child (1989) sets out the right to Education to which everybody is entitled. Education is important for exercising all other Human Rights and for development (South African Charter, 1989). Article 29 of the convention attaches importance to the process by which the right to Education is to be promoted.

Education opens up a world of opportunities reduces burden of diseases, poverty and gives greater voice in society. For nations, it opens doors to economic and social prosperity, dynamic workforce, well informed citizens able to compete and co-operate in the global arena. The Kenya Government is committed to providing quality education for her citizens. In this regard, Kenya has ratified international conventions and agreements (such as Jomtien Convention, 1990, and African Charter on the Rights and Welfare of Child, 1989) aimed at providing quality education. The government has invested in early childhood education such as in training teachers on how best to implement pre-school's curriculum.

The foundation of all science learning is first hand experiences with real things. Science experiences need not involve unusual elaborate or expensive apparatus and materials. MOEST and UNICEF in 2002 launched the child centered interactive approach to teach and learn science in and out of classroom environment by motivating and empowering learners and teachers. Creating a stimulating environment for science in and out of classroom help children learn the subject better. The child is able to relate prior knowledge and the concept to be acquired. Science is a practical subject and should be applied to everyday life. Teaching, learning activities and resources influence learning and general performance of

science in early childhood education resources available determine activities the learner is exposed to. The effect of this is seen in children's performance in primary and higher levels of learning. The school and the community should ensure that locally available resources are utilized for teaching and learning of science in pre-schools. Kenya Institute of Education (KIE) has developed manual for environmental (science) activities for effective learning of science in early childhood.

The content, methods and activities should be based on real life experiences to make science learning meaningful. This will ensure balanced growth of the child. Since resources available determine activities, the teacher has to be creative and innovative in the choice of teaching/learning materials and activities. Science activities are learnt best through inquiry method, which includes experiments and observation of phenomena events and properties of objects in their natural situations (pre-school activity guide).

According to pre-school teacher's activity guide, a teacher should develop simple experiments, which learners can understand and do on their own. In these experiments, a learner needs to be exposed to process skills such as formulating hypothesis, observing, experimenting and recording. This approach builds children's positive attitudes towards studying science in future. The activities and materials arouse learners questioning minds and should be organized in such a way that learners come up with their own discoveries. This way, a learner gets pleasure and satisfaction, which make him/her confident. The teacher should give each learner a chance to contribute to his or her learning. The teacher should provide a variety of play materials. Activities in science help the learner explore and understand the world around him, satisfy curiosity and get answers to questions. Experiments are important because they help the learner to start developing some concepts

and skills in science, which are vital for learning, understanding and appreciating science as a subject in later years.

The process skills which the teacher must endeavor to introduce and promote in children include observing, identifying, comparing, classifying or sorting, recording, predicting, experimenting measuring and controlling variables. The process skills also include data collecting, recognizing patterns and relationships, analyzing and interpreting, inferring and concluding and communicating the result. These together with introduction of basic facts in science form a firm foundation (Karaka, Nyangasi and Githii, 2004). The ‘passive’ approach in teaching science is where the teacher treats children like an empty pot and ‘pours’ information into it. A small amount may stay in but the rest is not retained. The ‘activity’ of ‘dynamic’ approach is where the children are active participants in the learning process. They are the doers, the materials they work with are the tellers and the teacher is the guide and facilitator in the learning situation (Karaka, Nyangasi and Githii, 2004).

Children cannot learn much by sitting and listening to the teacher. Therefore, the teacher should allow and encourage the children to explore, investigate, discuss, play, model and practice activities (Karaka, Nyangasi and Githii, 2004). The teacher should always realize that science is doing not just being told and therefore children should be actively involved in learning (Nyoroh, Sayles and Munguti, 2003). Children need real experiences because they are unable to think through ideas. They need to see for themselves, touch and do as much as possible. Learning as a result of first hand experiences is remembered. Learning by being told is easily forgotten (Nyoroh, Sayles and Munguti, 2003).

Nyoroh, Sayles and Munguti (2003) compare two classes visited. In the first class the teacher taught parts of a plant using a well drawn diagram of a plant on a chalkboard. In the second class, the teacher taught the same lesson by showing a whole plant. The classes were taken

outside and chose one plant per pair. In the second lesson children were reported to have learnt better because they learnt the smell and feel of a plant. They learnt different plants have different looking parts and different numbers of parts. They learnt different plants have different looking parts and different numbers of parts. They learnt that a plant is three dimensional, is delicate and that pollen may make them cough. In the first lesson, the children learnt about a plant and probably would be unable to recognize the parts in a different plant from the one drawn.

According to Karaka, Nyangasi and Githii (2004) the important role played by materials in learning science can be summarized by a Chinese Proverb that 'What I hear, I forget, What I see, I remember, What I do I know'. This proverb underscores the importance of children's own investigations in learning science. Since science is largely practical, children's investigations and materials help the teacher convey information or develop skills simply and clearly and to achieve desired results much faster.

Children understand best when they do activities themselves; working with and playing with real objects. They hardly benefit from listening and watching passively as the teacher talks or demonstrate without them taking an active part (Karaka, Nyangasi and Githii, 2004). Children learn through doing. Children attempt to understand the world around them by observing, hearing, exploring, experimenting and manipulating. Their hands are on everything they come across. Teachers need to give children plenty of activities that involve real concrete materials from the immediate environment (Njenga and Kabiru, 2007). Young children learn best through the senses. They learn when they look, listen, touch, taste and smell. A child understands concepts when presented in form of real objects, actions and situations (Njenga and Kabiru, 2007).

There are six activity areas taught in pre-schools in Kenya: environmental studies, language, number work, creative, social studies, and religious studies. Environmental studies include science activities in early childhood curriculum. The science activities serve as the foundation of science as a subject in primary school, higher levels of learning and application later in life. Science plays a crucial role in a children's future educational life. Science learning in pre-school is determined by the activities and learning resources the learner is exposed to. It is important that appropriate learning activities and environment is provided for meaningful learning.

1.2 Statement of the Problem

This study investigated the impact of pre-school children's own investigations on their performance in science. Science and technology are important in any developing economy. The vision 2030 identifies science, technology and innovation as vital in raising productivity and efficiency in economic, social and political pillars (Republic of Kenya, 2006). The government intends to devote more resources to scientific research, technical capabilities of the workforce and in raising the quality of teaching science and technology at all levels in institutions of learning. Kenya intends to have international ranking for her children's achievements in science and technology (Republic of Kenya, 2006).

Science enables the learners to understand the world around them. The scientific process involves curiosity, discovery, experiment, organization of information and reporting. Science is a doing subject. It should be taught carrying out activities rather than giving facts to children. They should be provided with plenty of activities with relevant, adequate and appropriate materials to be manipulated in a rich environment. Children learn better by first hand experiences. Children need real experiences because they help the child to think through ideas. They need to see for themselves, touch and do as much as possible. Learning science

as a result first hand experiences is remembered as opposed to learning by being told which is easily forgotten.

Learning science is a highly personal and individual process. The children must be actively involved in carrying out own investigations. This helps the teacher to convey information or skills simply and clearly to achieve desired results (Karaka, Nyangasi and Githii, 2004). Generally science is not well performed in schools in Isiolo District as shown by results in the table below. There is need to improve the performance. Table 1 shows science KCPE results in Isiolo primary schools from 2008-2010.

Table 1: KCPE Results Analysis in Science in Isiolo District

| Year | No. of Schools | Total Entries | Mean Score |
|-------------|-----------------------|----------------------|-------------------|
| 2008 | 43 | 1260 | 49.57 |
| 2009 | 46 | 1540 | 49.89 |
| 2010 | 49 | 1369 | 50.67 |

Source: DEO's Office, Isiolo

From Table 1, it can be seen that KCPE performance in Isiolo District ranges from a mean score of 49.57 in 2008 to 50.67 in 2010. Pre-school science activities lay a foundation for science taught in primary schools. However, there is no formal examinations that are conducted to determine how children transit from pre-schools to primary schools. Children's performance in primary school science is likely to be influenced by the way children are prepared in pre-school science activities. It is worth knowing that what happens in pre-school science activities may affect learning science at higher levels. Children in pre-schools do not sit for national examinations as they transit to primary schools and yet there are no studies that have been conducted to determine children's achievement in pre-school science

activities, especially in East Division in Isiolo District. Against this background, there is need to research on impact of children's own investigations on performance in pre-school science activities in East Division, Isiolo District, Kenya.

1.3 Purpose of the Study

This study investigated the impact of pre-school children's own investigations on their performance in science activities in pre-schools in East Division of Isiolo District.

1.4 Objectives of the Study

The objectives of this study were:

- i. Investigate the performance of children in pre school science activities when taught using traditional methods
- ii. Investigate the performance of children in pre school science activities when taught using traditional methods and children's own investigations.
- iii. Investigate the impact of children's own investigations in science activities on their performance.

1.5 Research Questions

The research study sought to answer the following questions:-

1. What is the performance of a child taught pre-school science activities using traditional methods?
2. What is the performance of a child taught pre-school science activities using traditional methods and one's own investigations?
3. To What Extent is the difference in performance between a child taught science activities using a child's own investigations and a child taught science activities using traditional methods in a pre-school?

1.6 Significance of the Study

The study highlighted main methods used in teaching and learning of science activities in pre-school education. Information was provided on the impact of children's own investigations on performance in science activities in pre-school. This may lead to improved learning process hence improved performance in science activities in pre-school. This would

lay a good foundation for science learning. Curriculum planners and implementers would be provided with indicators for interventions and modification of early childhood education programme. They may use the findings to formulate strategies that would to improved performance in pre school science activities and at other levels. It may assist in resource allocation so as to equip pre-schools and train personnel for better teaching and learning of science activities. It may help mobilize parents and other stakeholders to participate in pre-school science activities. Curriculum planners may have information for a comprehensive frame work for improvement of science teaching and learning.

The research study findings may provide necessary information to pre-school teachers, school administrators, the parents, community and other stakeholders for the improvement of science teaching and learning in early childhood education. The findings may also be of use by the ECE trainers and other officers for training for instructional strategies in science activities in Pre-School especially planning for science activities. Policy makers for ECE may benefit from the findings in terms of resource allocation to enhance effectiveness in teaching the subject. The study may also raise further issues and challenges leading to further research by other researchers interested in pedagogical issues in implementation of science curriculum in early childhood education.

1.7 Limitations of the Study

Due to limited resources sampling of pre-schools further into the interior was not done. Some schools were not sampled due to their inaccessibility from the main road and insecurity in the district due to cattle rustling.

1.8 Delimitations of the Study

The study was to investigate the impact of children's own investigations on their performance in pre-school science activities in East Division, Isiolo District. The study focused on children between ages 5-6 years old in pre-school pre-unit classes in East Division. The study

also focused on pre-school teachers and head teachers of pre-schools in East Division, Isiolo District.

1.9 Basic Assumptions of the Study

The study assumed that the teaching and learning resources were available for teaching science activities in pre-schools in East Division of Isiolo District. The early childhood education teacher had some professional training and could plan and organize science activities. The study assumed that the early childhood education teacher was familiar with Teacher's activity guides. It also assumed the respondents would answer questions correctly and truthfully.

1.10 Definition of Key Terms

| | |
|---------------------------|--|
| Children | Refers to pre-school children. |
| Investigation | To find out facts through observation, manipulation, feeling, seeing and doing things on their own in science. |
| Participation | To take part actively in pre-school science activities. |
| Performance | Outcome of learning. |
| Pre-School | Education setting serving ages 3-6 before joining primary school. |
| Science | Organized knowledge obtained by observing and testing of facts about the physical world, natural laws and society. |
| Science | Organized knowledge obtained by observing and testing of facts about the physical world, natural laws and society. |
| Science | Organized knowledge obtained by observing and testing of facts about the physical world, natural laws and society. |
| Science activities | Activities the learner is involved in to learn science in pre-school. |
| Teacher | Pre-school teacher. |

1.11 Organization of the Study

The study is organized into five parts. Chapter one deals with the introduction, background of the study, statement of the problem, purpose and objectives of the study. There are also research questions, significance of the study, delimitations of the study, limitations of the study and definition of key terms.

Chapter Two deals with literature review. In this there is introduction, education in ECE, general objectives of science, why learn science? Cognitive development and what is science. It also deals with role of children in learning science, science activities and purposes of practical work in science lessons. It also contains language, teaching and learning science, learner background, pre-school science activities and learning materials.

Chapter Three is on the methodology. It contains introduction, research design, target population, sample and sampling procedures and research instruments. It also contains, data collection procedures, validity and reliability of instruments and last but not the least data analysis procedures. Chapter Four deals with data presentation, analysis and interpretation of data collected during the study. Chapter Five is on summary, conclusions and recommendations of data collected during the study.

CHAPTER TWO: REVIEW OF RELATED LITERATURE

2.0 Introduction

This chapter reviewed literature on teaching of science in pre-school and the activities involved. The review focused on teaching and learning of science in pre-school.

2.1 Early Childhood Education

Sessional paper, Number 6 of 1988 defines the goals and objectives of ECDE as offering a non-formal education that aims to provide an all round development of children. According to Master Plan on Education and Training (1997 – 2010), the overall goal is to improve the quality of life of children aged 0-6 years. The objectives are improvement of health and nutrition, affective, cognitive, physical attributes, understanding environment, developing self confidence, free expression, spiritual and social values.

To co-ordinate ECE the government has set up an organizational infrastructure aimed at facilitating curriculum development, teacher training, research and general guidance and administration of the programme. This consists of pre-school at MOE, Pre-school section of inspectorate, NACECE at KIE, DICECE at district level (Comprehensive Education Sector Analysis Report, 1994). NACECE was established in 1985 and DICECE in 1985. NACECE coordinates development of early childhood education curriculum and support materials in Kenya. Materials include guidelines for trainers, teachers and sponsors of pre-schools. The widening scope of early childhood education and particularly the focus on nutritional, health care and aspects of child development have resulted in a number of innovative measures. These include community mobilization for parents and local community in provision of feeding programme, growth monitoring and primary health services.

DICECE coordinates ECE programs at district level. There is an ECED section in the primary Education Division at the Ministry of Education. The nurture of children in pre-school age group is very important. It is not only the natural right of each child, but also a

key variable in developing the country's human resource base. The child is most vulnerable to environmental influences during this period. Several studies show that growth deficiencies that occur during this period are difficult and sometimes impossible to reverse. In pre-school science is taught as environmental studies. In primary school it is taught as elementary science while in secondary school it is taught as biology, chemistry, physics, general science and physical sciences.

2.2 General Objectives of Science

The general objectives of learning science are to develop ability to observe and explore the environment, develop skills for rational decision making develop creativity and critical thinking in addressing new and emerging challenges. Also develop and use appropriate science process skills and technologies for solving problems, develop positive attitudes about oneself and the environment. They also include managing and conserving the available resources, improve body fitness and maintain good health, acquire basic knowledge and develop interest in science and science related careers.

The objectives determine content and teaching approaches. They also help affective teaching and learning resources and instructional activities. Specific objectives are testable and are considered in constructing assessment items. The teacher is encouraged to use specific objectives to evaluate learners. Rai and Richardson (2003) observed that instructional activities should be properly planned. This is because once achieved, they lead to achievement of general objectives and goals of education. As part of the preparation for teaching/learning activities, two important documents are needed. These are schemes of work and lesson plan. Schemes of work are teacher's plan of action for instructional activities. Lesson plan enables a teacher to systematically and effectively teach a particular lesson.

Why learn science?

According K.I.E (1987) science gives learners an opportunity to think critically. The pre-school children should be accorded an opportunity to learn science as a basis for learning in future. Science syllabus recommends that teachers use three approaches when teaching science heuristically. The first method allows children to learn independently as they acquire knowledge, skill and attitudes as they interact with the environment. The other one is child centered approach which refers to learning based on the interest of the child. The teacher is a facilitator. The third approach is participatory approach. This encourages a child to take part individually or in a group, to explore and manipulate materials in the environment to enhance learning (K.I.E, 1987)

Science has intrinsic value as a body of accumulated knowledge and as a way of finding out about the world. Learning science is a means for helping individuals to fulfill their own personal potentials. Learning science helps the individual to live in a society and both to contribute to it and benefit from it. Science is as much part of our culture as is music, literature or parliamentary democracy: for this reason alone, science can be justified as a key part of any school curriculum and that claims to transmit the culture. Pre-school teachers' activities guide explains that in preschool, children learn science so as to develop their observation and discovery skills. They learn to keep good health habits and maintain good health through a balanced diet, adequate exercise and rest. They should become familiar with their environment their culture and use easily available materials. Learning to play, carry out and analyze science teaches learners many skills which if retained and transferred to other situations can be useful in many walks of life. Good science teaching does not only create confidence on the part of the learners built also helped realize that it is possible to make sense of many aspects of science to have understanding of ways in which scientific knowledge is gained and accepted.

Cognitive Development of Pre-school Children

Cognitive development during early childhood is marked by high level of curiosity and numerous questions. The questions that children ask help them to reason and to think about cause and effect of various situations in life. These questions are extremely important because they indicate an increase in mental development. Through these questions children start understanding their environment better and why things happen the way they do. (Njenga and Kabiru, 2005) children ask 'what' and 'why' questions in order to understand the world around them. Some children attempt to understand the world around them by observing, hearing, exploring, experimenting and manipulating (Njenga and Kabiru, 2005).

Children learn best through the senses (Njenga and Kabiru, 2005) Learning involves all things they touch, see, smell, taste and experience within their surroundings. The child understands ideas and concepts when presented in form of real objects, actions and situations (Njenga and Kabiru, 2005). Children discover how things smell, taste, feel and look. They experiment with different things therefore making discoveries and this increases their knowledge and concepts. Children learn by doing. They learn by hands on experiences with real material and meaningful activities. Learning is an active process, which involves the whole child. They should be exposed to many types of materials in the environment. They learn through practice, observation, imitation, exploration and problem solving. As they engage in different activities they develop strategies or different ways of acquiring information and solving problems.

2.3 Learning Science

Science is thought to be a hard subject. Science teaching has focused on the academic, teaching the fundamental principles with the assumption that, through a grasp of the fundamental principles and technologies, the application of science would emerge. This is

why the practitioners of science rely heavily on controlled experiment so that particular observations can be made. In science therefore high value is placed on the use of measurement and numerical analysis for the verification and validity of information. There is need to identify why practical work is done in science education so that the teacher identifies his/her role in science practical lesson.

Wellington, (1998) observes that we do not do practical work because science is practical subject, but so as to build a bridge between realm of objects and observable properties on the open hand, and realm of ideas on the other. Practical are therefore done with the sole intention of making observations about particular scientific principles. The teacher is vital in directing learners in making observations. The step of generating an explanation is essentially creative and imaginative. The foundation of all learning in science is first hand experience with real things. Science experiences need not involve unusual, elaborate or expensive apparatus and materials. This explains why a science teacher has to be creative and innovative in the choice of teaching and learning materials.

Bentley and Watts (1993) argue that teachers need to adopt new and different approaches to teaching and learning sciences. One scientific concept can be explained to the understanding of learners through different approaches. The teacher need not dwell on the practical to explain a concept. Practical are in most cases done in groups. This enables learners to discuss the development of an experiment from its set up, observation to the conclusive explanation. Such skills of teaching science can be imparted on science teachers if they are exposed to similar experiences as their learners. Teachers would have an opportunity to air some of the problems they encounter in classroom settings.

2.4 Science in Early Childhood Education

According to Bennett (2003), performance in investigations according to the related science concepts, pupils performed less well in investigations set in everyday contexts than in

scientific contexts; and pupils had particular difficulties with investigations involving two independent variables. Teaching of science in early childhood can be influenced by among other things by; the specification of the curriculum, work scheme plan of activities and teaching strategies employed. Teachers' role is important in helping learners discover concepts. It is therefore the responsibility of the teacher to create an appropriate learning environment both in terms of stimulating resources and supportive social dynamics.

Evaluation of previous lessons helps in planning and teaching strategies. Teachers are trained in skills of writing a lesson plan. This is done through the use of preprinted pro-forma plan. Planning a lesson or a sequence of lessons involves specifying objectives, specifying Knowledge and skills, selecting and sequencing learning activities and evaluating the outcomes. The teacher should choose tasks appropriate for development of learners understanding of science concept and procedures. It is the duty of the teacher to take note of diversified range of individual abilities and aptitudes. It is called differentiation and defined as a planned process of intervention in the classroom to maximize potential based on individual abilities and aptitudes. The teaching strategies employed on a science lesson have a great impact on the success of science.

2.5 Language, Teaching and Learning

Wellington (1998) stresses that although science is practical subject, teaching and learning occurs through a medium of instruction, both spoken and written. In early childhood education this is the language of the catchment's area which can be English, Kiswahili, and sign language (deaf), brail (blind) or even vernacular. It is common knowledge in Kenya that language presents a barrier to learning in general not only in science. Concept words in science may present difficulties to learners and may become more abstract no matter how easy they may seem to the teacher.

2.6 Role of Children in Learning Science

According to Karaka, Nyangasi and Githii (2004) learning is a highly personal and individual process. The children must be actively involved i.e. carry out investigations, develop curiosity and powers of observation and inquiry, explore basic questions and suggests solutions. They must manipulate a variety of materials in search for patterns and relationships while looking for solutions to problems (Karaka et, al, 2004). The teacher must prepare appropriate materials for learning activities, motivate children, discuss and co-ordinate activities to achieve desired objectives. He or she should assess the activities and suggest solutions to problems. The teacher must make an effort to teach children how to learn so that they can work as independently as possible.

According to Njenga and Kabiru (2005), children use their sense to explore the environment, manipulate objects and discover the nature of things, now they work and relate. They discover how things smell, taste, feel and how they look like. Children break things up and construct others to see what will happen. They experiment with different things making discoveries and this increases their knowledge and concepts. Children learn by doing. They learn by hands on experiences with real materials and meaningful activities. Learning is an active process which involves the whole child. Children learn through practice, observation, imitation, exploration and problem solving. When they explore and experiment, they discover new things and ways of doing things. As they engage in different activities they develop strategies or different ways of acquiring information and solving problems. This is referred to as learning how to learn.

2.7 Learner Background

Social economic status impacts on learning in general and in this case in science subjects in ECE. Learners from low socio-economic backgrounds face problems at home and at school which comprises their learning. At home, they may not get sufficient motivation from

parents who do not set high educational standards, and who are not capable of providing educational materials and educational experiences such as trips and books. There is a correlation between socio economic status of the student and mathematical performance. Higher socio-economic status is likely to lead to better performance of children in school.

2.8 Science Activities

According to K.I.E (2003), pre-school teachers' activity guide series. Science activities are learnt best through inquiry. This includes experiments and observation of phenomena, events and properties of things in their life situations. The main aim of these activities is to create awareness and understanding of the world that surround the child. This makes the child appreciate the environment he lives in. The environment includes learner, people, animals, plants and all other natural and man-made things round the child.

Through participation in the activities, the child learns to be social and respect others and share facilities and materials willingly. The child should interact with the environment all the time through visits and experiments. These help the child to explore and understand the world around, satisfy curiosity and at times get answers to some questions regarding environment. Experiments help the child start developing some concepts in science and skills which are vital for 'learning, understanding and appreciating' sciences as a subject in later years. At Pre School, teachers should develop simple experiments which children can understand and do on their own. These activities include skills such as guessing outcomes (hypothesis), observing, experimenting and recording. This approach will build positive attitude towards the study of science and social studies in future. The activities provided such as stories and riddles will enable the child to grow and develop morally.

The activities and materials should arouse child's questioning mind and help in discoveries. This way the child gets pleasure and satisfaction which makes him or herself confident. Practical work is often regarded as being the doing activities rather than the knowing,

qualities of pupils (Macintosh, 1978). Practical work involves the application of knowledge, use of theoretical concepts and theoretical evaluation of results obtained by the practical experience.

A discovery lesson is fun for both teacher and children. It provides a break from classroom routines of prescriptive lessons or programmed instructional material (Moline and Moline, 1973). Discovery lessons lead to independence on part of thinking child. Creative thinking is a problem solving process. It calls on an individual to use his own knowledge and experience to work out an answer that satisfies a deeply felt need for self expression (Strom, (ed.) 1971).

Science should be taught through multi sensory technique. This is teaching through the senses which include smell and taste, touch, hearing or seeing (Wellington and Wellington, 1960). Multi Sensory technique is the use of any auditory or visual sense or of any other medium appealing to senses which helps students grasp the fact, an idea, a concept or an attitude. Teaching aids assist teachers to add concreteness to their presentation of material; and must know how to plan for, to use, and to evaluate these aids. Failure to employ this approach, the teacher comprehends little of the role senses play in the steps of thinking. Sense of hearing should always be joined to that of sight, and the tongue should be trained in conjunction with the hand (Wellington and Wellington, 1960). The subjects should not just be taught orally and thus appeal to the ear alone, but should be pictorially illustrated. Multisensory materials utilize different senses for intensifying learning. Multisensory technique in problem solving awakens anxiety at the beginning of new topics, assumes form of demonstration by the teacher and provides information needed to solve defined problems. For example, in biology a film on reproduction should provide the information needed by students to solve their problems in this area. Slower students learn more from concrete

material. However, material aids do not teach for the teacher, but should only be utilized as part of problem solving and critical thinking.

2.9 Purposes of Practical Work in Science Lessons

Kerr (1963) conducted a study involving 700 science teachers in 150 schools – asked to rank in order of importance ten possible aims of practical work to encourage accurate observation and careful recording, to promote simple, common sense, scientific methods of thought, to develop manipulative skills, to give training in problem solving, to fit requirements of practical examinations, to verify facts and principles already taught, to be an integral part of the process of findings facts by investigation and arriving at principles, to arouse and maintain interest in the subject and to make scientific phenomenon more real through actual experience.

According to Watson (2000), purposes of practical work in science lesson are to encourage accurate observation and description, to make scientific phenomena more real, to enhance outstanding of scientific ideas, to arouse and maintain interest (particularly in younger pupils) and to promote scientific method of thought. Woolnough and Allsop, (1985) suggest three fundamental aims of practical work which justify its inclusion in school science curriculum. These are development of practical scientific skills and techniques, problem solving and getting a feel for phenomena.

2.10 Suggested Science Activities

According to Kenya Pre-School Teachers' Activities Guide (K.I.E, 2003) the following methods are recommended:

- **Oral discussion** – here the teacher may explain something new or allow children to discuss freely and share experiences. This enables children to develop their language and confidence.

- **Riddles, stories, poems and songs** – the teacher should allow children to share riddles stories, poems and songs relevant to the topic.
- **News telling-** children tell news about their homes clothes they wear, places they visit and others. News telling helps children develop their language, confidence and memory.
- **Dramatic play-** and make believe activities teacher should provide materials for children to engage in role play freely. They initiate situations in their lives.
- **Dramatization-** teacher organizes children to perform a play to enable them understand a given situation better. Role of the teacher is to organize plan and provide all required materials.
- **Experiments-** this helps children find out causes and effect relationship. Nature and science corner in class should have materials found within the environment. It should have many things for children to smell, feel, listen to and experiment with. Children should discuss activities they do as this will help to increase their vocabulary and improve their command of spoken language.
- Other methods include modeling painting and free play at sand or water corners.

2.11 Learning Materials

Since children learn best through firsthand experience, a wide variety of materials should be provided in ECE so that they may engage in various activities. Exposure to various materials and activities helps them to learn and to remember what they learn and thus enjoy their learning. Teacher should organize collection and making of materials. Collected materials should be safe for children's use. It is important that children learn about materials in the natural environment. Many pre-school activities will involve taking children outside the

classroom so that they can observe things under different conditions without interfering with them. It is best for the teacher to start using materials that are familiar with the children and introduce unfamiliar ones later. Such use of materials will help children develop confidence in the use of materials.

Every child should be given a chance to participate and contribute to learning. Teacher should provide a variety of materials to play with as teacher guides them to solve problems. This should enhance the acquisition and development of new values. These activities produce all round development of the child. The activities and materials should be relevant to culture and age of the child (K.I.E, 2003). According to Rai and Richardson (2003), teaching or learning aids are intended to provide children with real life experiences. Children have an opportunity to use their full senses (touch, sight, smell, hear and feel) to enhance learning. This helps in conceptualization of otherwise abstract ideas and helps understanding mastery and retention of the ideas or concepts. Learning aids therefore need to be used as often as possible and should be relevant for the lesson.

2.12 Teaching Methods

Learners learn best by carrying out activities related to what is being learnt. Teaching approaches should therefore be participatory to ensure that children acquire science process skills, enjoy learning and apply what is learnt to everyday life. Retention of knowledge that is actively acquired through activities is much higher than that learnt passively. Science is learnt through different approaches.

Participatory approaches suitable in science learning include demonstration, practical activities, guided discussion, projects and field trips.

Demonstration – it is important to have clear objectives. Children should always be involved. Ensure that they are involved through questions, making observations, recording results and discussing conclusions. (K.I.E, 1987)

Practical activities include investigating, viewing such as using lens, modeling and measuring. The teacher needs to prepare the practical in advance and if necessary try them out before the lesson (K.I.E, 1987). Learners should be given clear instructions before the lesson. The activities can be done individually or in groups or collectively as a class. Theories of learning underscore the fact that children learn through doing (Nderitu, Kihara and Onguti, 2005). Activities can be planned depending on the environmental conditions such as weather and time available for single or double lessons (K.I.E, 1987).

Projects and Long Term Practical Activities

Project work stimulates and motivates the learner. It instills a sense of responsibility and commitment if proper guidance and supervision are provided. Field trips and excursions should be encouraged. The local environment should be considered to cut costs such as school compound and local neighbourhood to study plants and animals. Also trips to weather stations and local market (Rai and Richardson, 2003). Children learn and derive a lot of pleasure from visiting places of interest (K.I.E, 1987)

2.13 Assessing Children in Pre-School

Pre-school teacher's activities guide (KIE, 2003) suggest that performance may be assessed through questioning, observing children during dramatization and play, listening to children as they discuss and play. The teacher can observe the children to see how well they participate and do in various activities. A teacher can also use oral test or interview, practical work and written tests (Rai and Richardson, 2003).

Direct observation is done as individual children carry out various activities. This is one of the most reliable methods of obtaining information about children's performance. It enables a teacher to determine how willing, responsible, motivated and co-operative as well as the

extent to which scientific skills such as manipulation and simple experiments have or have not been achieved.

Oral questioning is a method where the teacher asks oral questions whose response helps the teacher to determine whether that particular child has understood the concept being taught at every stage. Oral questioning also helps a teacher to assess his or her effectiveness in teaching.

Oral tests or interviews are useful. A teacher prepares questions which are put to the children one by one. Through this the teacher is able to determine a child's level of achievement.

Practical work is a method in which children are given tasks or problems to solve. The teacher marks the work as children perform an experiment, or the finished product which could be an apparatus, a drawing, a model a display or results obtained.

Written tests are the most commonly used methods of assessment.

2.14 Theoretical Framework for the Study

According to Cognitive Learning Theory, the mind of the child is the key factor in determining whether a child learns or not. Learning results in a permanent change of behavior manifested in a child's performance. It is the individual child who is to learn. Cognitive development deals with thinking, problem solving, intelligence and language.

It is a combined result of maturation and experiences that help individuals to adapt to environment. Differences in rates of development are attributed to differences in genetic timetables, cultural and environmental influences (Orodho, 2004). Individual children need different experiences to complete their cognitive development. In early childhood Education, Children should be seen and treated as unique individuals, and allowed to develop science process skills at their own rates (Orodho, 2004).

The pre-school teacher has therefore to facilitate learning by ensuring that the child is a key participant in what is happening, to gain mastery of environment. The child has to be active in terms of searching for or constructing knowledge and solving problems. The pre school teacher facilitates and motivates the child to do own investigations because he or she is a productive thinker. The teacher has to use different methodologies through which children learn in order to cater for individual differences. The environment should be ideal for sensory approach to learning (KIE, 2003).

2.15 Conceptual Framework for the Study

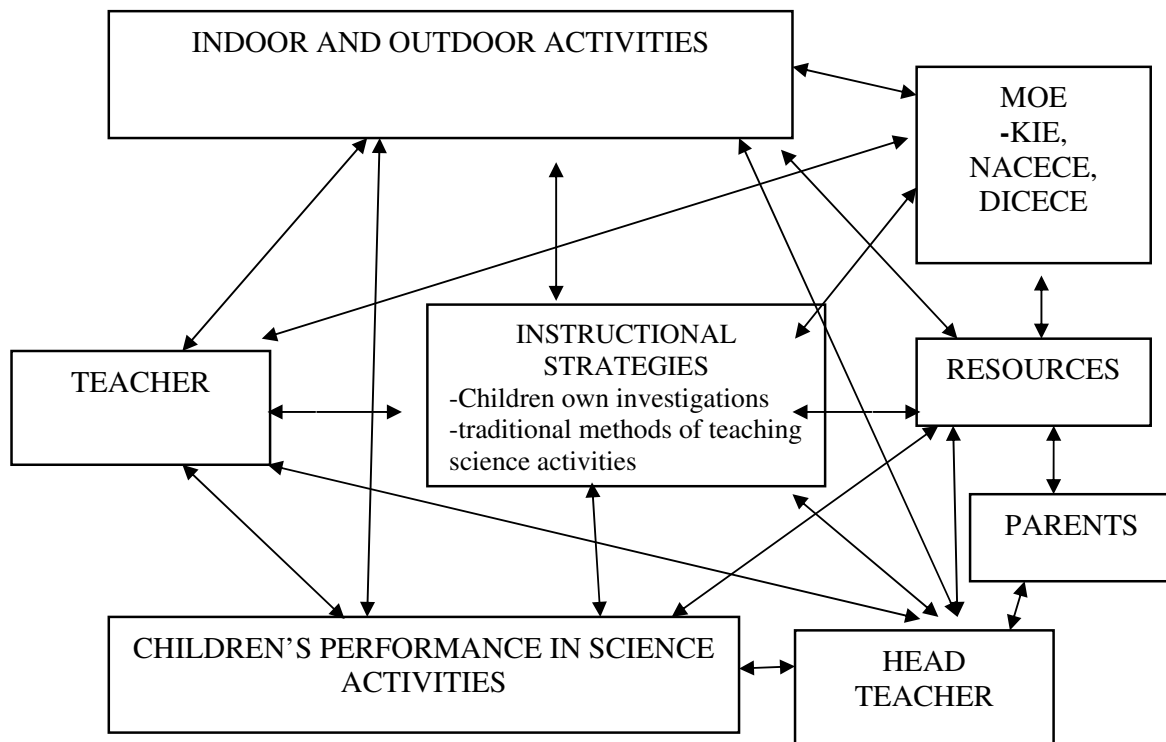


Figure 1: Conceptual Framework for the Study

The arrows in the figure show how variables relate with one another. The resources determine the activities and instructional methods. The methods in turn affect learning resources, activities to be planned, teacher preparations and performance.

In the frame work factors that impact on performance in science activities include:

- Instructional strategies such children's own investigations.
- Teacher related factors like training, planning of the lesson, organization of resources and methodology.
- Parents factors such as provision of resources for science activities.
- Nature of activities such as practical or theoretical. If appropriate instructional strategies are employed learning of science becomes easy, interesting and enjoyable.

All these factors impact on performance of science in early childhood education.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This chapter focuses on research design and methodology. It describes the procedures that were used to collect the data. It deals with research design, the target population, sample and sampling procedure, research instruments, validity and reliability of the instruments and data collection procedures.

3.2 Research Design

A research design is the scheme, outline or plan used to generate answers to research problem (Orodho, 2004). It constitutes the blue print for the collection, measurement and analysis of data (Kothari, 2003). The research used quasi-experimental design. It involved random selection of two groups of pre-schools. Group A was experimental and group B was control schools.

Same scheme of work and lesson plan was developed by the researcher and the pre-school teacher for use with the two groups. Group A (experimental) was taught science activities using traditional methods of teaching and children's own investigations. Group B schools (control) were taught science activities using traditional methods. Both groups were taught for same length of time. Same test was administered to schools in both groups after the lesson. Classes were left intact. The mean scores, standard deviations, *t*-scores and *P*-values were computed using SPSS software. This enabled the researcher to compare performance of the two groups of pre-schools.

3.3 Target Population

Population is the theoretical set of all possible observations for a particular experiment. If the observations are numbers, then the population is described by the distribution function of the observation which gives the probability of occurrence for each possible numerical value. The size of the population places an upper limit on the size of sample that can be drawn from it. In this study the population consisted of pre-schools in East division of Isiolo District which

are attached to both public and private schools. It involved pre-school children, teachers and head teachers.

3.4 Sample Size and Sampling Procedures

A sample is a small group obtained from the accessible population. Each member in a sample is referred to as a participant (Mugenda and Mugenda, 1999). There are Eighteen (18) pre-schools in East Division, both public and private in Isiolo District. There was random selection of ten (10) pre-schools in which research instruments were used. Eight were public schools and two private. This ensured that every pre-school had equal chances of being selected. The selected pre-schools were grouped into two: Group A was experimental schools while group B were control schools. Each group had five pre-schools. Only children, teachers and head teachers of the selected pre-schools were included in the study.

3.5 Research Instruments

The research used three instruments: tests, questionnaires and observation checklist. Test was the main instrument for the study. It was constructed based on research questions and schemes of work developed by teacher and researcher. Same test was administered for both experimental and control groups of pre-schools at the end of teaching session and scores were recorded. The researcher examined children's performance scores for every pre-school. Mean scores, standard deviations, *t*-values and *P*-values were also computed for the two groups of schools (experimental and control). These values were used to compare performance of children in science activities in the experimental and control pre-schools.

Observation Checklist

The researcher used observation checklist to determine facilities and resources available for science activities teaching and learning. This helped collect unbiased report on the situation on the ground. Children's investigations were observed.

3.6 Questionnaires

Questionnaires were used in the study. There was a questionnaire for head teachers and another for pre-school teachers. Head teachers questionnaire collected information on facilities and resources at the pre-school, their acquisition and sources of funds for maintaining the pre-school. Pre-school teacher's questionnaire helped collect information on their qualifications, teaching and learning resources available and their acquisition. Also their attitude towards teaching science activities and the methods they use to teach. It also used to gather information on challenges encountered in teaching science activities in pre-schools.

3.7 Data Collection Procedures

The researcher used various methods to collect data such as observation and questionnaires. Same test was administered to children in the selected pre-schools. Observation was done to establish facts on the ground such as facilities, science instructional material such as text books, science corner and presence of water in the pre-school. Observed also were playgrounds and play materials. Children's investigations during science lesson were observed. Same scheme of work and lesson plan were used to teach the science lesson. Same test was constructed and administered to children in the sampled pre-schools. The tests were marked out of 100% and scores recorded. The researcher used an observation checklist to observe and record facilities and resources available for use in science lessons. Questionnaires were given to school head teachers and pre-school teachers. They were filled and collected later.

3.8 Validity of the Instruments

Validity is concerned with establishing whether the instrument measure what it is supposed to measure (Orodho, 2004). Research instruments were developed based on research questions. To ensure validity, the supervisors were consulted before the study commenced. Pre testing of instruments was done after which corrections were done.

3.9 Reliability of the Instrument

Reliability of measurement is the degree to which a particular measuring procedure gives similar results over a number of repeated trials (Orodho, 2004). Science activity lesson was taught using traditional methods for control group of pre-schools and own investigations for the experimental group. Same test was constructed and was administered to the two groups after the lesson. The test was marked out of 100% and scores recorded.

3.10 Data Analysis Procedures

On completion of data collection, the researcher marked the test out of 100% and recorded the scores. Data was grouped according to its category, that is experimental and control schools. Performance index for every pre-school was computed and means scores determined. The mean score and standard deviation for each category was computed. *t*-Scores and *P*-values were computed using SPSS software. Data from questionnaires was tabulated and analyzed. Data was tabulated and analyzed using and percentages.

CHAPTER FOUR: FINDINGS AND DISCUSSIONS

4.0 Introduction

This chapter contains the findings of this study. It is presented in tabulated form as well as recording of relevant observations made during the study. Means and percentages are used.

Standard Deviations, *t*-scores and *P*-values were also computed using SPSS software and were used to compare the performance.

4.1 Research Findings

The total number of Pre-schools in East Division of Isiolo District is eighteen (18). Ten (10) pre-schools were sampled for the study. Five pre-schools were in the experimental group while five were in the control group. This is 55% of target population. The researcher chose this sample size on the grounds that a larger one would give more data for better comparison of the test scores and performance of pre-school children in science activities. Questionnaires were administered to the teachers in the pre-schools. All the questionnaires were filled and returned. Some pre-school teachers did not respond to some items. All questionnaires from head teachers were filled and returned. The total number of children who did the test was 307. Eight pre-schools are attached to public primary schools and two are under the church. All pre-schools are day schools. Resources in pre-schools are not adequate. The situation is complicated by the fact the communities continue to maintain pre-schools, including paying the teachers' salaries. Parents pay high fees especially in private pre-schools. This has resulted to poor parents taking children to public pre-school which lack facilities such as classrooms, play materials and other learning materials.

4.2 Background information

The study collected information on pre-school teachers' professional qualifications. The analyzed information results are shown in Table 2.

Table 2: Teachers Qualifications in East Division, Isiolo district

| Qualifications | Frequency | % |
|-----------------------|------------------|------------|
| Untrained | 1 | 10 |
| Certificate | 8 | 80 |
| Diploma | 1 | 10 |
| Total | 10 | 100 |

From Table 2, it can be seen that 80% of the teachers are trained up to certificate level, 10% of them are trained up to diploma while only 10 % are not trained. It shows that the majority of the teachers have necessary skills required to teach effectively at pre-school level.

The study established pre-school teachers' use of resources and the analysis results are shown in Table 3.

Table 3: Pre-school Teachers Use of Resources in East Division, Isiolo District

| | Frequency | % |
|--------------|------------------|------------|
| Always | 5 | 50 |
| Sometimes | 3 | 30 |
| Rarely | 1 | 10 |
| Others | 1 | 10 |
| Total | 10 | 100 |

From the analysis (Table 3), 50% of pre-school teachers always use resources to teach science activities, 30%of them sometimes while 10%of them use them rarely. This suggests

that the majority of teachers use resources in teaching pre-school science activities. Resources are important in teaching and learning science and they are necessary to help in children's own investigations. Pre-school teachers therefore should ensure that resources are used in science.

Availability of teachers activity guide was investigated and the results are shown in Table 4.

Table 4: Availability of Teachers Activity Guide in Pre-Schools in East Division, Isiolo District

| | Frequency | % |
|---------------|------------------|------------|
| Available | 8 | 80 |
| Not available | 1 | 10 |
| No response | 1 | 10 |
| Total | 10 | 100 |

From the table 4, it is evident that the majority of the pre-school teachers (80%) had teachers activity guide, 10% did not have and 10% gave no response to the item. This indicates that most of the pre-school teachers are aware of the suggested activities that can enhance children's own investigations in pre-school science activities.

Other science text books are important for learning science activities in pre-school. Information on availability of other science text books was gathered and results are shown in Table 5.

Table 5: Science Text Books Available in Pre-Schools in East Division, Isiolo District.

| Challenge | Frequency | % |
|------------------|------------------|------------|
| Text Books | 8 | 80 |
| No Text Books | 2 | 20 |
| Total | 10 | 100 |

From Table 5, 80% of pre-schools have science text books while 10% have no text books. This shows that most of the teachers can teach pre-school science activities effectively. Textbooks are essential and should be provided for effective teaching and learning of science activities at pre-schools.

Funds are important for pre-schools. They pay teachers, buy resources and are used for general development. All head teachers (100%) agreed that teaching and learning resources have an impact on pre-school science. Data on provision of funds is shown in Table 6.

Table 6: Funding for teaching and learning resources Pre-Schools in East Division, Isiolo District.

| Source | Frequency | % |
|---------------|------------------|------------|
| Government | 6 | 60 |
| Parents | 2 | 20 |
| Sponsor | 2 | 20 |
| Total | 10 | 100 |

From Table 6, government provides funds to 60% of pre-schools, parents 20% and sponsor 20%. This shows that the government provides funds to most of the pre-schools. Funds are important for acquisition of teaching and learning resources for effective teaching of science

activities. Teaching and learning resources in science are acquired through various ways. The government gives community support grants to pre- schools. Sponsors provide some funds to maintain Pre-schools. Other resources are prepared by teachers and parents. Some teachers involve children in collecting locally available materials.

All head teachers supported the fact that the pre-schools should improvise for the resources by involving teachers, children and parents in collecting them from local environment.

The research graded the performance as follows: Scores ranging between 70- 100 as above average, 40-70 as average and 0-40 as below average. The results are shown in Table 7.

Table 7: Grading of performance in East Division, Isiolo District.

| Performance | Experimental | Control |
|--------------------|---------------------|----------------|
| Above average | 100 | 0 |
| Average | 0 | 80 |
| Below average | 0 | 20 |
| Total | 100 | 100 |

From Table 7, it can be seen that 100% of the pre-schools in experimental group scored above average. In control schools no pre-schools scored above average. Only 80% of the control group of pre- schools scored average and 20% of them scored below average. This suggests that children’s own investigation has an impact on performance in science. This reveals that experimental group had better performance as illustrated in Table 7. Children’s own investigations should be applied to compliment traditional methods of teaching. A child learns best by carrying out activities related to what is being learnt. Teaching approaches should therefore be participatory to ensure that a child acquires process skills, enjoys learning

and apply what is learnt to everyday life. Retention of knowledge that is actively acquired through activities is much higher than that learnt passively practical activities stimulates and motivates a child. The table gives information on the impact of the above teaching methods on the two categories of schools.

Teachers were asked to rate different teaching methods in pre-school science activities. Responses to items were given numerical values using frequencies of number of respondents choosing a particular method and percentages were computed as shown in Table 8.

Table 8: Teacher Rating of Teaching Methods in pre-schools in East Division, Isiolo District

| Method | Frequency | Percentage (%) |
|---------------|------------------|-----------------------|
| Experiment | 3 | 30 |
| Observation | 3 | 30 |
| Discussion | 2 | 20 |
| Poems | 1 | 10 |
| Story telling | 1 | 10 |
| Totals | 10 | 100 |

From the results in Table 8, 30% of pre-school teachers rated experimental as a good method while 30% of them indicated that observation method was a good method for teaching science activities. It can also be seen that 20% of the teachers felt that discussion method was good in teaching pre-school science activities while 10% of them indicated that poems and storytelling were good methods of teaching science activities. Pre school teachers are aware of different teaching methods and should use them different methods in teaching science activities.

4.3 Findings on Research Question 1:

What is the performance of a child taught pre-school science activities using traditional methods?

The first objective sought to investigate performance of a pre-school child in science activities when taught using traditional methods. During the study, control schools were taught using this method. In this, the child was not encouraged to do own investigations. It was teacher centered where she talked and demonstrated, giving the child little or no chance to participate in learning science activities. Tests were administered and marked out of 100%. The results for analyzed data are shown in Table 9.

Table 9: Children’s Test Scores in Control Schools in East Division, Isiolo District.

| | Enrolment | Total scores | Mean scores (%) |
|-----------------|------------------|---------------------|------------------------|
| Barracks Isiolo | 51 | 2942 | 58 |
| MCK Highway | 37 | 1960 | 53 |
| Mwangaza | 22 | 1370 | 62 |
| St. Kizito | 17 | 880 | 53 |
| Kambi Bulle | 24 | 760 | 32 |
| Total | 151 | 7912 | 52 |

From Table 9, it can be seen that the total enrollment was 151, total scores of pre-schools were 7912 and the total mean score was 52. In this group children recorded above scores with 80% of schools getting a mean score ranging between 50-70 and 20% of the school had a mean score of 32. The mean scores were as follows: 62,58,53,53, 32. This suggests that pre-school children perform well when taught using traditional methods.

4.4 Findings on Research Question 2:

What is the performance of a child taught pre-school science activities using one's own investigations?

This Question sought to investigate the performance of a pre-school child in science activities when taught science activities using traditional teaching methods together with a child's own investigations. During the study period, teachers taught science activities using traditional methods and facilitated learning and gave children a chance to participate fully in learning activities through inquiry or own investigations. By so doing, children formulated their own hypothesis on given activities in which they designed experiments to test their hypothesis. Same test was constructed based on the scheme of work .The test was administered after the teaching session, marked out of 100% and scores recorded. The mean scores were computed and results shown in Table 10.

Table 10: Children's Test Scores for Experimental Schools in East Division, Isiolo District.

| School | Enrolment | Total scores | Mean scores (%) |
|---------------|------------------|---------------------|------------------------|
| Hekima | 61 | 5160 | 85 |
| Kiwanjani | 32 | 2360 | 74 |
| Prisons | 27 | 2220 | 82 |
| Ngaremara | 30 | 2210 | 74 |
| Miracle | 6 | 430 | 72 |
| Total | 156 | 12380 | 77 |

In this group better performance was recorded. Total enrolment was 156, total scores were 12380 and total mean score were 77. All pre-school had mean scores above 50. The following scores were recorded 85, 82, 74, 74, and 72. In this group of pre-schools, children's performance is high with mean scores ranging between 72-80.100% of schools scored 70 and above. This shows that a child's own investigations have impact on learning and performance of children in pre-school science activities. Pre-school teachers should use

children’s own investigations to teach science activities since the study show that it leads to good performance.

4.6 Research Questions 3:

To What Extent is the difference in performance between children taught science activities using children’s own investigations and children taught science activities using traditional methods in a pre-school?

The control and experimental group of pre-schools were taught using same schemes of work and lesson plans developed by researcher and the teacher. The control group of pre-school was taught using traditional methods only while experimental group was taught using traditional methods and children’s own investigations. The researcher and the teacher constructed a test and marking scheme based on the schemes of work .Same test was administered to control and experimental groups after the teaching session. Marking was done by the researcher and the pre-school teacher out of 100%. The scores were recorded. Mean scores were computed and graded as above average (70-100), average (40-70) and below average (0-40). Standard deviations, *t* and *p* values were computed using SPSS software. To find out whether children’s performance in both control and experimental groups of schools were different, a two sample (independent) *t*-test was done in which *t*-scores and *p*-values were established. The analyzed results are reported in Table 11.

Table11: Impact of children’s own investigations on their Performance in Pre-school Science in East Division, Isiolo District.

| Group | Mean | S.D | df | <i>t</i> | <i>p</i> |
|----------------------|-------------|------------|-----------|-----------------|-----------------|
| Control schools | 51.60 | 11.569 | 8 | - 4.463 | .002 |
| Experimental schools | 77.40 | 5.727 | | | |

From Table 11, it can be seen that the control group of schools had mean and standard deviation of 51.60 and 11.569, respectively, while the experimental group of schools had a mean and standard deviation of 77.40 and 5.727, respectively. The difference in performance

of children in control group of schools and those in experimental group of schools was found to be statistically significant ($t(8) = -4.463, p = .002$, two tailed). This suggests that children who are taught science activities using traditional methods of teaching and inquiry approach (children's own investigations) perform better than those who are only taught science activities using traditional methods of teaching. The difference in performance is due to interventions (treatment) done to the experimental group of schools.

This finding suggests that in addition to teaching children science activities using traditional teaching methods, the children should also be involved in conducting their own investigations during science activities in pre-schools. Children's own investigations is where they formulate own hypotheses, design own experiments and perform them, analyze results and draw conclusions. Children's own investigations should be used to compliment traditional methods.

4.6: Discussions

The findings of the study agree with the pre-school teacher's activity guide (KIE, 2004), which requires the teacher to develop simple experiment which children can understand and do on their own. The activities and materials should be organized in such a way that children come up with their own discoveries. The teacher should give each child a chance to contribute to his or her learning. Pre-school science activities help children explore and understand world around, satisfy curiosity and get answers to questions. The findings support Karaka, Nyangasi and Guthii, (2004) that a child should be active participant in learning where they are the doers, the materials are the tellers and the teacher is the guide. The children cannot learn by only sitting and listening to the teacher. Therefore the teacher should allow and encourage the children to explore, investigate, discuss, play, model and practice science activities. Children need real life experiences because they are unable to think through ideas. They need to see and touch for themselves (Nyoro, Sayles and Munguti,

2003). Experimental method of teaching and learning science activities is supported by (KIE, 2003), which says that science activities are best learnt through inquiry. The results of the study concur with Rai and Richardson (2003), who say that teaching or learning aids are intended to provide children with real life experiences. Children have an opportunity to use their senses (touch, see, smell, hear and feel) to enhance learning. This helps in conceptualization of otherwise abstract ideas and helps understanding, mastery and retention of ideas or concepts. Learning aids therefore need to be used as often and should be relevant for the lesson.

CHAPTER FIVE: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter contains the summary of the study, conclusions from the findings and recommendations for possible action and further research.

5.2 Summary of the study

The Study was set up to investigate the impact of pre school children's own investigations on performance in science. The researcher was out to find out how the above methods of teaching affect performance. In respect to the above, performance as a variable was investigated. To establish the impact of the method, the following research questions were addressed. What is the performance of a child in pre-school science activities when taught using traditional methods? What is the performance a child in Pre-school science activities when taught using own investigations? What is the impact of a child's own investigations in pre-school science activities on their performance? Literature was reviewed on role of children in learning science, science activities and purposes of practical work in science. Others include suggested science activities, materials, teaching methodologies and ways of assessing children in science activities. The study used quasi experimental design to carry out the investigations. Two groups were used: One experimental and the other control. The target population comprises pre-schools children, teachers and head teachers in East Division of Isiolo District.

Random selection or sampling of Pre-schools was done to obtain the sample. The study used ten pre-schools of which five were control and five were experimental, ten Pre school teachers and nine head teachers. A scheme of work and a lesson plan were prepared by both researcher and pre-school teacher. The study also used questionnaires for sampled head teachers and pre-school teachers. Observation checklist was also employed to establish some facts on the ground. Validity was ensured by involving supervisors in examining the tools.

Data was analyzed using descriptive statistics; frequencies, percentages and Mean scores were computed for the different variables so as to enable data interpretation. Standard Deviations, *t*-statistics and *P*-values were also computed. The research findings are discussed below:

The Mean Scores and Standard Deviations of control group of schools were 51.60 and 11.589 respectively while those of experimental group were 77.40 and 5.727 respectively. The difference was found to be statistically significant ($t(8) = -4.463$, $p = .002$, two tailed).

Children learn through the senses. Own investigations are powerful in learning science. Learning involves all things they touch, see, smell, taste and experience within the surroundings. The child understands ideas and concepts when presented in form of real objects, actions and situations. They experiment with different things therefore making discoveries and this increases their knowledge and concepts. They learn by hands on experiences with real materials and meaningful activities. They learn through practice, observation, imitation, exploration and problem solving. As they engage in different activities, they develop strategies for different ways of acquiring information and solving problems. The pre-school teacher has therefore to facilitate learning by ensuring that the child is the key participant in what is happening.

The child has to be active in terms of constructing knowledge and solving problems. The teacher facilitates and motivates the child to do own investigations. According to analysis obtained, children had higher mean scores in the experimental group as compared to control. This is where children used their own investigations in science. A 100% of schools had a mean of 50 and above with the highest at 85% and lowest at 72%. The method proved to be of much help to average and below average children because they learnt practically. In traditional method, children did not participate fully in the learning process and therefore had low mean scores with the lowest at 38%. This is because science is a doing subject. This

suggests that children who were taught using traditional and own investigations or inquiry methods combined performed better than those taught using traditional methods only. The difference can be attributed to treatment or interventions done to the experimental group of schools. The inquiry method of teaching and learning science is more appealing to children. Poor performance by the control group of schools point to the fact that children should be guided to learn through their own investigations in science.

5.3 Conclusions

The study intended to investigate the impact of pre-school children's own investigations on their performance in science. The following conclusions can be drawn from the study. It establishes the fact that children's own investigations in pre-school science activities have an impact on performance. Children's performance in the experimental group was better than in control group. This is where they were involved in own investigations. Schools in control group had lower Mean Scores and higher Standard Deviations of 51.60 and 11.589 respectively. Schools in experimental group of had higher mean Scores and lower Standard Deviations of 77.40 and 5.727, respectively. The statistically significance difference between the two group of Pre- schools ($t(8) = -4.463$, $p = .002$, two tailed) suggest that children in experimental group perform better than those in control group of schools where only traditional methods were used to teach science. Thus in addition to teaching science using traditional methods, children should be involved in own investigations in science .Science is largely a doing subject and children know more of what they do than what they hear. They need see, touch, smell and do as much as possible of their own investigations. They are unable to think through ideas and therefore hands on activities and first hand experiences make learning better for them. The teacher should give each child a chance to contribute to learning.

5.4 Recommendations

The study makes the following recommendations. In addition to teaching children using only traditional methods in science in Pre-school, they should be involved in own investigation activities. Pre-school teachers should involve children in their own investigations so as to better performance in science activities. Science learning should be made more practical than theoretical. Teachers should prepare science lessons in advance so as to get the necessary materials for the lesson. Activity guides are essential and suggested activities are important. Schools and communities should be encouraged to participate more in provision of resources for learning in pre-school. Production and use of localized curriculum support materials should be strengthened to address the problem of shortages. The study also recommends that cost of training of Pre-school teachers should be reduced so that all teachers can be trained. Cost of learning in pre-school should also be reduced. The government should make early childhood education free and compulsory. Increase of government allocations in maintaining pre-schools will go along way in providing resources among other things hence improving performance in science activities at this level. District education boards and constituency development funds should prioritize early childhood education in allocations for development projects so as to provide necessary resources and facilities to teach science activities and make pre-schools child friendly. This will improve performance not only in science activities but also in other areas. Extension of quality assurance services to Pre-schools will help to monitor and improve performance in science as well as other areas.

5.5 Recommendations for Further Research

The study recommends that more studies need to be done in other areas apart from teaching methods. This may include studies in tackling challenges facing teaching of science activities in pre-school. Studies on how school head teachers and other teachers' attitude including those of pre-school affect performance in science activities are worthwhile. Since this study only targeted science activities, a similar study should be done in teacher's classroom practices during science activities as well. A study may be done on how type of instructional materials used during children's own investigations influence children's performance in science activities.

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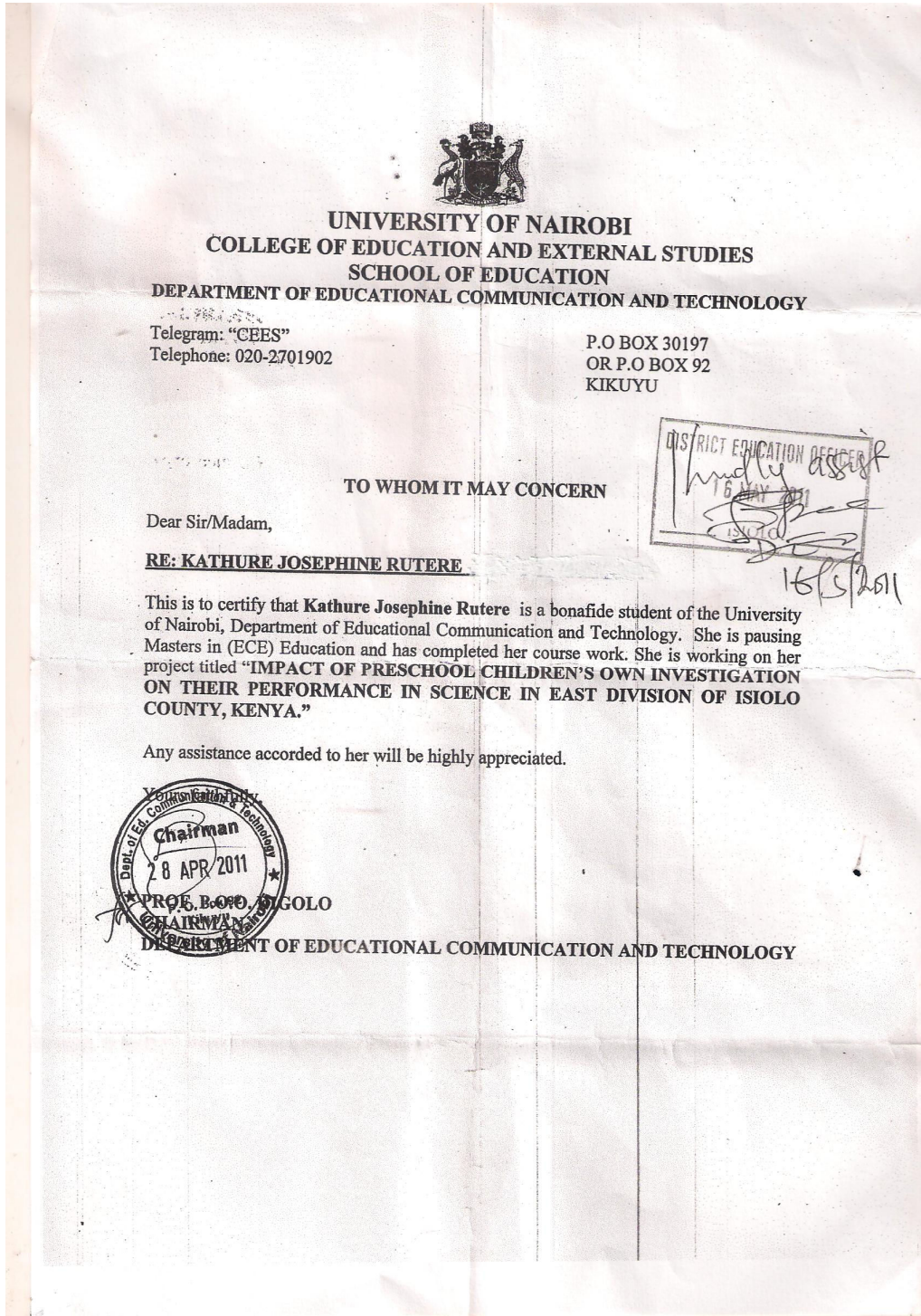
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APPENDICES

Appendix I: Letter of Introduction



Appendix II: Head Teachers Questionnaire

1. Name of school
2. Location
3. How big is ECE centre in terms of space?
.....
4. How many and how big are the classrooms?
.....
5. What is the type of buildings? Permanent [] Temporary []
6. What is the general condition of the building (s) Good condition [] Need repair []
7. Do you have play ground Yes [] No []
8. What were sources of funds for running and maintaining the ECE centre?
.....
.....
9. What are sources of water in the school?
Piped [] Rain [] Well []
River [] No water []
10. How do you acquire teaching and learning resources?
.....
.....
11. Do you consider them adequate? Yes [] No []
12. How do you improvise for resources in science?
.....
.....
13. Do you think the learning resources have an effect on learning science?
Yes [] No []

Appendix III: Questionnaires for Pre-School Teachers

This questionnaire is for the purpose of research only. Do not write your name. The responses will be treated confidentially.

Tick in the appropriate bracket

1. Name of the Pre –school.....
Zone
Division
2. Gender Male [] female []
3. How old are you?
18 – 24 []
25 – 34 []
35 – 40 []
41 – 44 []
45 and above []
4. What are your academic qualifications?
K.C.P.E []
K.C.S.E []
Other (specify)
5. What are your professional qualifications?
Certificate []
Diploma []
Degree []
Other (specify)

6. In your own opinion how is science?
 a) Easy [] b) Hard [] c) Enjoyable []
7. Do you enjoy teaching science? Yes [] No []
8. Do you prepare for science lessons in advance? Yes [] No []
9. What method do you mainly use to teach science?
 a) Practical [] b) Theory [] c) Both []
10. How do learners respond to practical lessons where they do their own investigations?
 a) Enjoy [] b) Don't enjoy []
11. Do you consider time available for teaching science adequate to engage fully in various activities?
 a) Yes [] b) No []
12. How often do you use teaching and learning resources in science lessons?
 a) Always [] b) Sometimes [] c) Rarely []
13. Who provides these resources?
 a) Teacher [] b) School [] c) Children [] d) Parents []
14. Are the resources provided adequate for science activities?
 a) Adequate [] b) Fairly adequate [] c) Not adequate []
15. In your own opinion do you think it is important to involve learners in science practical activities in and out of class? a) Yes [] b) No []
16. How often do you involve learners in outdoor activities?
 a) Always [] b) Sometimes [] c) Rarely []
17. Do you think children's own investigations in activities above affect performance
 Yes [] b) No []
18. How often do you do experiments?
 a) Always [] b) Sometimes [] c) Rarely []

19. Do you have a nature or science corner in your classroom?

a) Yes [] b) No []

20. Do you have water or a sand corner in your classroom?

a) Yes [] b) No []

21. Do you have pre-school teachers' activity guide? a) Yes [] b) No []

22. If yes do you follow the suggested activities?

a) Yes [] b) Sometimes [] c) No []

Comment

.....

23. How useful are the suggested activities in your opinion?

a) Very useful [] b) Useful [] c) Not useful []

24. How do you consider the following methods of teaching sciences?

| Method | Very Good | Good | Inadequate |
|---------------|-----------|------|------------|
| | | | |
| Discussion | | | |
| Poems | | | |
| Drama | | | |
| Role Play | | | |
| Story Telling | | | |
| News Telling | | | |
| Painting | | | |
| Modeling | | | |
| Songs | | | |
| Observation | | | |
| Experiment | | | |
| Field Trips | | | |
| Practical | | | |

25. How often do you involve learners in these activities?

| Method | Always | Often | Rarely |
|---------------|--------|-------|--------|
| Lecture | | | |
| Discussion | | | |
| Poems | | | |
| Drama | | | |
| Role Play | | | |
| Story Telling | | | |
| News Telling | | | |
| Painting | | | |
| Modeling | | | |
| Songs | | | |
| Observation | | | |
| Experiment | | | |

26. What are your main challenges in teaching science in pre-school?

- a) Lack of resources []
- b) Lack of materials []
- c) Lack of time for preparing []
- d) Lack of text books []
- e) Un co-operative environment []
- f) Others

24. What are your general comments about teaching science in pre-school?

Comments:

.....

.....

.....

Appendix IV: Research observation checklist

Name of school

Location

| Facilities/resources | Available | Fair condition adequate | Poor condition/inadequate | Permanent | Temporary |
|-----------------------------|------------------|--------------------------------|----------------------------------|------------------|------------------|
| Head teacher office | | | | | |
| Staffroom | | | | | |
| ECE classroom | | | | | |
| Science text books | | | | | |
| Nature corner | | | | | |
| Science corner | | | | | |
| Sand corner | | | | | |
| Water corner | | | | | |
| Play ground | | | | | |
| Playing materials | | | | | |
| Learning aids | | | | | |
| Toilets/latrines | | | | | |

Appendix V: Pre-School Children's Science Test

NAME.....

SCHOOL.....

ANSWER THE FOLLOWING QUESTIONS.

CHOOSE THE CORRECT ANSWER

1. In our school we get water from..... (Tap, Borehole, River).
2. A stone in water (Floats, Sinks).
3. A paper..... in water (Floats, Sinks).
4. A padlock in water (Floats, Sinks).
5. A leaf in water (Floats, Sinks).
6. A stringin water (Floats, Sinks).
7. A piece of Clothin water (Sinks, Floats).
8. Things that sink in water are..... (Heavy, light).
9. Things that float in water are..... (Heavy, Light)
10. A feather is (heavy, Light)

Appendix VI: Sample Scheme of Work

| WEEK | TOPIC | SUB – TOPIC | OBJECTIVES | ACTIVITIES | MATERIALS | REFERENCES | REMARKS |
|------|-------|----------------------|--|----------------------|--|---|---------|
| 1 | Water | Sinking and Floating | By the end of the lesson, learner should be able to: | | | Higher flier,(2007) Comprehensive Nursery class encyclopedia, Nairobi: Higher flier pages 7-8 KIE (2003) Kenya preschools Teachers' Activity guide series book 3 page 102 - 103 | |
| | | | Say the poem 'water is life' Spell words sinking and floating | Say poem | Flash cards | | |
| | | | Count letters in the words sinking and floating | Count letters | Flash cards | | |
| | | | Name the objects that sink and float | Name objects | Chart showing a poem | | |
| | | | Group the objects that sink and ones that float in water | Put objects in water | Water, stones, feathers, bottle tops, leaves, papers, pieces of cloth, coins, padlock, grass, spoons, pens, chalk, cans, nails | | |
| | | Test | Test understanding of the covered work | Write a test | A written test | Test papers | |