DETERMINANTS OF USE OF INQUIRY BASED INSTRUCTION BY EARLY CHILDHOOD TEACHERS’ IN TEACHING SCIENCE IN MERU SOUTH SUB-COUNTY, KENYA

JOACHIM NJAGI
E55/OL/14826/2009

A THESIS SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTER OF EDUCATION (EARLY CHILDHOOD STUDIES) IN THE SCHOOL OF EDUCATION OF KENYATTA UNIVERSITY

MAY, 2016
DECLARATION

I declare that this is my original work and has not been presented in any of the university/institution for consideration of any certification. This research proposal has been complemented by referenced sources duly acknowledged. Where text, data (including spoken words), graphics, pictures or tables have been borrowed from other sources, including internet, these are specifically accredited and references cited using current APA system and in accordance with anti-plagiarism regulations.

Signature: ........................................ Date: 16/05/2016
Joachim Njagi (E55010/4626/2009)
Department of Early Childhood Studies

SUPERVISORS

We confirm that the work reported in this thesis was carried out by the candidate under our supervision as University supervisors.

Signature: ........................................ Date: 17/05/2016
Dr. Gladwell Wambiri
Department of Early Childhood Studies

Signature: ........................................ Date: 17/05/2016
Dr. John Teria Ng’asike
Department of Early Childhood Studies
DEDICATION

To my family and close friends who have been there to encourage and challenge me over the years.
ACKNOWLEDGEMENTS

I would like to thank God the almighty, who makes all things possible for putting the enthusiasm in my heart, inspiration and encouragement in my mind, and determination in my soul to complete this research work.

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ABBREVIATIONS AND ACRONYMS

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<th>Description</th>
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<tr>
<td>CBM</td>
<td>Curriculum Based Management</td>
</tr>
<tr>
<td>CPE</td>
<td>Certificate of Primary Education</td>
</tr>
<tr>
<td>DICECE</td>
<td>District Centre for Early Childhood Education</td>
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<tr>
<td>ECDE</td>
<td>Early Childhood Development and Education</td>
</tr>
<tr>
<td>KCE</td>
<td>Kenya Certificate of Education</td>
</tr>
<tr>
<td>KCPE</td>
<td>Kenya Certificate of Primary Education</td>
</tr>
<tr>
<td>KCSE</td>
<td>Kenya Certificate of Secondary Education</td>
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<tr>
<td>KHA</td>
<td>Kenya Headmistress Association</td>
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<td>KIE</td>
<td>Kenya Institute of Education</td>
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<tr>
<td>MoEST</td>
<td>Ministry of Education Science and Technology</td>
</tr>
<tr>
<td>NACOSTI</td>
<td>National Commission for science, Technology and Innovations</td>
</tr>
<tr>
<td>NARST</td>
<td>National Association for Research in Science Teaching</td>
</tr>
<tr>
<td>UNESCO</td>
<td>United Nations Scientific and Cultural Organization</td>
</tr>
<tr>
<td>SbTD</td>
<td>School-based Teacher Development</td>
</tr>
<tr>
<td>SMASE</td>
<td>Strengthening of Mathematics and Science Education</td>
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<tr>
<td>SPRED</td>
<td>Strengthening Primary Education</td>
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<tr>
<td>TEPD</td>
<td>Teacher Education Professional Development</td>
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Members of the society require science skills to cope with technologically-changing world. Despite this realization, the performance in science subjects is still below the required standards worldwide. The impetus to conduct this study stemmed from the fact that science education plays a significant role in the child’s development as it can bridge the gap in education achievement in science performance at higher levels of learning. The purpose of this study was to investigate the determinants of early childhood teachers’ use of inquiry-based instructional approaches in science activities. The main objectives of this study were to: establish the extent to which teachers used inquiry-based instructional approaches in teaching science in early childhood development education, investigate the extent to which teachers’ level of training influences use of inquiry-based instructional approaches in teaching science in early childhood development education, determine the extent to which the type of training institution influences use of inquiry-based instructional approaches in teaching science in early childhood development education and examine the extent to which teaching experience influences use of inquiry-based instructional approaches in teaching science in early childhood development education. The target population for this study was 270 teachers. Eighteen teachers were purposively selected to take part in the study. The instruments for data collection were phenomenological interview and science lesson observation schedules. Interview questions were pretested on two teachers from Maara Sub County. Credibility of the study instruments was established through member check, prolonged engagement, persistent observation, peer debriefing, triangulation, multiple data sources and by comparing pretest results from the pilot study in two districts. The reliability of the study instruments was ensured by keeping accurate descriptions and interpretations of respondent experiences and corroboration of the data by participants at all stages of the research process. This study adopted in-depth phenomenological interviewing of participants for 30 minutes. The researcher randomly selected and observed three separate science lessons taught by each teacher in the study sample. Descriptive statistics including frequency counts and percentages were used to summarize and organize quantitative data while data elicited by interview questions and observation were analyzed qualitatively using content analysis. The responses were thematically discussed. The study found that there was limited use of inquiry-based instruction in science teaching. The result shows that the teacher’s level of training, type of training institution and teaching experience had no significant influence on teachers’ use of IBI. This study concluded that teachers were currently practicing inquiry-based instruction and that the level of training, experience and type of training institution did not significantly bring about differences in the use of inquiry-based instructional approaches. The recommendations from this study are that the Government should prioritize the allocation of instructional resources to promote the practice of inquiry-based learning. This study recommends training of teachers on the use of inquiry-based learning approaches in pre-primary schools.
CHAPTER ONE

CONTEXTUALIZATION OF THE STUDY

1.0 Introduction

This chapter presents the background of the study, statement of the problem, purpose of the study research objectives and questions. The significance of the study together with delimitations and limitations of the study are also presented in this chapter. The chapter ends with the presentation of theoretical and conceptual framework and operational definition of terms.

1.1 Background to the study

Inquiry-based learning is an approach that deals with activities that are aimed at discovering new knowledge through scientific investigations (Alberts, 2011). Inquiry based learning approaches consists of experiences that enable learners to explore occurrences to arrive at concepts and principles, guided by the instructor (Handelsman, Miller & Pfund, 2007). According to Harlen and Allende (2009), Inquiry-Based Instructional Learning consists of experiences that help learners to understand the world around them through the development and use of inquiry skills. Inquiry-based curriculum assumes learners learn gain new knowledge by asking questions, identifying problems, and conducting investigations. This is followed by collecting, analyzing and interpreting data for the purposes of creating comprehensive explanations before drawing conclusions (Marx et al. 2004). As highlighted by Hmelo-Silver, Duncan and Chinn (2007), the inquiry processes address various thinking and learning skills such as critical thinking, creative thinking, communication skills, self-regulated learning skills, as well as metacognitive abilities. According to Harlen and Allende (2009), inquiry based...
instructional learning at pre-primary school level facilitates the acquisition of scientific knowledge as well as consolidation of scientific concepts in young learners. They also add that such learning sharpens the children inquiry skills thereby creating a favorable environment for the early development of attitudes and perceptions.

United Nations Scientific and Cultural Organization (UNESCO) (2010) arguments points to the fact that science through inquiry should continue to be regarded as an integral part of the pre-primary curriculum as it enables young learners to generate new ideas about the world around them, which is critical in establishing a suitable climate for scientific literacy. The experience gained from undertaking scientific inquiry allows children to appreciate how science works. Science through inquiry can help children have a clear picture of how science directly impacts various aspects of their lives such as health and safety. Involvement in scientific activity leads to the realization of the significance of reasoning about evidence, which is a prerequisite of future learning in science and beyond.

According to National Association for Research in Science Teaching (NARST, 2011), inquiry skills are foundational for the development of the more complex science skills hence should be given due emphasis in the early years of primary education. Karen (2010) contends that scientific inquiry provides the opportunity for children to develop a range of skills, either explicitly or implicitly. Karen (2010) highlights various activities that are conducted during inquiry learning. First, there is exploration of objects, materials and events in order to raise questions, make careful observations, as well as engage in simple investigations that involve describing, comparing, sorting, classifying and ordering objects. This is followed by recording
the observations using words, pictures, charts and graphs. In that case, one can use a variety of simple tools to extend observations, identify patterns and recognize relationships. In addition, there can be development of tentative explanations and ideas through working collaboratively with others by sharing ideas and listen to new perspectives. The main focus of this study was to establish how teachers used the highlighted activities for inquiry learning in pre-primary schools.

The foregoing description of the practice of teaching and learning science is notably different from the actually experience in the pre-primary classrooms. Typically, science lessons in pre-primary classrooms is characterized by a science table that has interesting objects and materials for the learners to see as well as the measurement and observation tools such as balances and magnifiers (Karen, 2010). In such cases, children are unable to make proper observations or ask related questions for that can enhance their understanding. Activity-based science is also another form of science that is used in the pre-primary learning. Here, children are allowed to engage in activities that regenerate excitement and interest (Karen, 2010). Despite having a multitude of science books supporting it, activity-based science rarely lead to deeper thinking as compared to other form of science used in the classrooms (Duschl, Schweingruber & Shouse, 2007). Science work can also be carried out through use of thematic units and projects. Although this may seem rich and effective way of conducting science work, it actually may lack the focus on science. From this perspective, arguments in favor of the need for better science education in pre-primary schools have largely been based on the desire to assist the today’s learners in developing new knowledge, reasoning abilities and problem solving skills required for the rapidly technological world. (Johnson & Adams, 2011).
Despite the potential benefits of using inquiry in science learning, there are several drawbacks with the use of inquiry instruction. For instance, empirical studies carried out in America by Cobern, Schuster, Adams, Undreiu, Applegate, Skjold and Gobert (2010) show that curriculum and pedagogical reforms, inadequate teacher training on pedagogical approaches and lack of support from Government and Education Ministries on implementation of inquiry-based learning brings about the disconnect between the way the science curriculum is structured and the way teaching is being implemented in classrooms. In 1996, the United States National Academy of Sciences produced the National Science Education Standards that emphasizes on inquiry-based science, based on the theory of constructivism rather than on direct instruction of facts and methods. However, Chisholm and Leyendecker (2008) argue that despite the science curriculum being well-planned, encouraging more learner-centered and competency-based education, the teaching of science using IBIL has relatively been unsuccessful implying that a gap exists between the expected goals of curriculum and actual progress achieved in classrooms.

Pre-Primary schools are the gateway for many children in many countries in Africa (Osborne & Dillon, 2008). The majority of the developing countries in Africa began to experience a remarkable transformation in the science curriculum development in the 1970s. Initially, the science-related learning programmes used to be adopted from other development nations but that proved to be detrimental to learning because such programmes had been developed for a different cultural background. Subsequently, national curriculum development activities have incorporated approaches from a collection of externally produced programmes which are not easily workable in an African setting due to resource constraints in most primary
schools (Horn, 2009). Thus, the process of science, including such elements as the scientific method of inquiry and critical thinking are often ignored.

In Kenya science is a key component of the pre-primary school curriculum. According to the Kenya Institute of Education (KIE) (2003), the general objectives of science at the pre-primary level are: to develop children’s curiosity, create opportunities for them to observe, hypothesize, experiment and report or record findings as well as helping them to develop problem solving skills and acquiring science concept such as measuring, weighing, speed, floating and sinking and solubility. The KIE (2008) pre-primary school syllabus, refers to science activities as those scientific tasks that involve direct experience and participation of the children to acquire basic scientific skills like observation, manipulation, classification, measurement, communication, experiment designing, prediction, problem solving, recording and questioning. The children should be able to use the five senses that is, smelling, feeling, hearing, tasting and seeing as they perform various activities to discover scientific facts and ideas. Therefore, teaching science has to focus on developing analytical, critical skills, and problem solving abilities as well as enhancing the creativity of an individual (Mudulia, 2012; Atieno, 2013).

The current Kenya’s pre-primary science curriculum advocates for learner-centred approaches with children active involvement in practical investigative activities which nurture scientific skills (KIE, 2008). Pre-Primary Science Syllabus is the foundation for scientific studies at higher levels. The syllabus has also considered the desired outcomes of education for our pre-primary school learners’ as well as putting emphasis on the national education. The pre-primary science syllabus is
based on the Science Curriculum Framework and emphasizes the need for a balance between the acquisition of science knowledge, process and attitudes.

Central to the framework of science curriculum is the enhancement of spirit the scientific inquiry. The pre-primary science curriculum in Kenya aims at nurturing the learner as an inquirer (KIE, 2008). It all begins with the nature of children, who under normal circumstance are curious about things that are around them and would not hesitate to explore them when given the opportunity. Their curiosity and urge to make the world a more predictable place is certainly what propels them to explore, draw conclusions, and eventually make theories from their experiences. However, it is inappropriate to entirely leave such activities to them because they are not polished enough to be natural scientists. Children need guidance and support in order to turn their curiosity into something more scientific. They need to practice science more often so that they engage in rich scientific inquiry. The science curriculum leverages on and attempts to promote this spirit of curiosity (Njenga & Kabiru, 2007).

The end result is a community of learners who enjoy science and value it as an instrumental tool of helping them to explore the greater natural world (KIE, 2008). Therefore, teachers are encouraged to make use of inquiry approaches when teaching by incorporating ideas and materials from various sources, in order to enhance the learning of science. However, despite the curriculum suggesting use of inquiry based learning approaches, there is a problem in what is suggested and what is being practiced in pre-primary science classrooms in Kenya. There could be competing demands within the classrooms which hinder teachers from sticking to the established curriculum. One such demand is the fact that pre-service and new
teachers struggle with classroom management as well as the goal of surviving (Lustick, 2009). A lack of knowledge and experience with inquiry instruction could also act as a barrier (Blanchard, Southerland & Granger, 2009). Several studies have that primary school teachers are not well-placed to be effective inquiry-based science teachers. They tend to lack adequate knowledge on how science inquiry works, especially in the implementation inquiry-based teaching in their classrooms (Lee et al. 2009). Scant attention has been given in training teachers to prepare lesson plans using inquiry-based instructional approaches.

Majanga, Nasongo and Kareto (2011). argues that science teachers in pre-primary schools in Kenya have continued to use the traditional approaches in which learners are compelled to master content knowledge rather than developing their skills as well as nurturing of the inquiring attitudes. To prepare children to become scientist, science should be taught through process skills of inquiry (Asiago, 2010). Consequently, a laboratory experience becomes a critical part of teaching and learning of science because it enables teachers to harness the process skills of learners. Unfortunately, the majority of Kenyan pre-primary schools are faced with the unavailability of laboratories and resources thereby making teachers to rely on the hands-on inquiry activities in teaching science-related subjects. There could be many other factors other than unavailability of laboratories that can challenge the effectiveness of inquiry based instructional approaches in teaching science in pre-primary schools in Kenya (Ndegwa, 2005). Although the challenges facing science teachers in pre-primary schools in Kenya continue are inherently present in education system, the Ministry of Education Science and Technology (MoEST) continues to regularly address curriculum instructional issues. The interventions
being used include; Strengthening Primary Education (SPRED) programme, School-based Teacher Development (SbTD) programme and, the Strengthening of Mathematics and Science Education (SMASE) programme (Republic of Kenya, 2008). From the above discussion, it is evident that there are significant problems with the manner in which science teaching at pre-primary level is currently being conducted in Kenya.

In Meru South Sub County, science teachers in pre-primary schools are using talk and chalk, memorization, expository method and less inquiry methods of teaching science activities despite the curriculum emphasis on use of more inquiry based learning approaches (Uwezo, 2011). Science should be taught by doing or carrying out activities rather than giving facts to children. Plenty of activities with relevant, adequate and appropriate materials to manipulate must be provided (KIE, 2008). This would make children develop scientific skills and knowledge which are important in developing strong scientific foundation. Inquiry method of teaching should be mostly employed in teaching science in pre-primary schools as this would encourage investigative attitude on the side of the learners (Uwezo, 2011). Therefore, the implementation of science curriculum through inquiry based instruction even in higher levels could be influenced by factors that are rooted in early childhood education. Lack of empirical studies in this area leaves a gap in knowledge that needed to be filled. This study sought to find out the determinants of use of inquiry based instruction by early childhood teachers’ in teaching science in Meru South Sub-County, Kenya.
1.2 Statement of the problem

Pre-school science instruction is important because it is within the formative years that adequate exposure to scientific concepts and processes is thought to be crucial to future scientific achievements (Ian & Shannon, 2013). Therefore for children to perform well in science as at pre-primary school to higher levels of education and become skilled scientists, teachers should lay a firm foundation in science as a subject during the formative years.

Parents and educators in Kenya have expressed a lot of concern over learner’s poor performance in science both in primary and secondary schools (Ngasike, 2010). Not only do Kenyan pre-primary school children underperform in science-related subjects, but are also naïve to the ideas about scientific phenomena compared to those in other countries. Regrettably, they transfer such inefficiencies to primary school and high school making it hard for them to survive in colleges (Uwezo, 2011). SMASE has come up with a programme for training secondary and primary school science teachers. However, the intervention does not focus on pre-primary teachers. This implies that despite efforts to solve the problem of poor performance in science at other levels of education, there could be challenges at the pre-primary level.

In Kenya there is a problem emanating from the way the pre-primary science curriculum is structured and what is being practiced in classrooms. Studies have been conducted on contextual and teacher factors affecting the teaching of science in primary schools, but little has been done in relation to the approach of teaching science in pre-primary schools. Notably, studies on inquiry based learning that are available in Kenya (Njue, 2010; Asiago, 2010 & Walala, 2010) have focused on
other activity areas like mathematics. Furthermore, these studies have focused on factors influencing teachers’ choice of inquiry at secondary school. The foundations of scientific concepts are laid during the early childhood years. It was crucial to understand the factors influencing the use of inquiry based instructional approaches in early childhood.

1.2.1 Purpose of the study

The purpose of this study was to establish the determinants of use of inquiry based instruction by early childhood teachers’ in teaching science in Meru South Sub-County, Kenya.

1.2.2 Objectives of the study

a) To establish how teachers used inquiry based instructional approaches in teaching science in pre-primary schools.

b) To find out how teachers’ level of training influences use of inquiry based instructional approaches in teaching science in pre-primary schools.

c) To determine how the type of training institution influences use of inquiry based instructional approaches in teaching science in pre-primary schools.

d) To examine how teaching experience influences use of inquiry based instructional approaches in teaching science in pre-primary schools.

1.2.3 Research questions

The following questions emanated from the objectives:

a) How are teachers using inquiry based instructional approaches in teaching science in pre-primary schools?

b) How does level of teacher training influence use of inquiry based instructional approaches in teaching science in pre-primary schools?
c) How does type of training institution influence use of inquiry based instructional approaches in teaching science in pre-primary schools?

d) How does teaching experience influence use of inquiry-based instructional approaches in teaching science in pre-primary schools?

1.3 Significance of the study

The findings of this study may be useful to teachers, teacher educators, curriculum developers and educational researchers who are interested in science inquiry and constructivism in early childhood education. The findings of this study may inform the delivery of science lessons in pre-primary school learning environment through teacher training and resource allocation for better teaching and learning of science activities. Curriculum developers could use the findings of this study to come up with a comprehensive framework for improvement of science teaching and learning in pre-primary schools.

1.4 Limitations and delimitations of the study

This section presents a description of situations and circumstances that may affect or restrict the researcher’s methods and analysis of research data. In this section the researcher also describes the parameters of the investigation.

1.4.1 Limitations

The major constraint experienced was that observation of science lessons was occasionally affected by multiplicity of other factors such impromptu inspection of schools by Quality Assurance and Standards Officers which the researcher had no control over. In such circumstances, the researcher re-scheduled the lesson observation to another day.
1.4.2 Delimitations

The study was delimited to Meru South Sub County and therefore the findings mainly reflected the situation in this Sub County. Specifically the study involved teachers in public pre-primary schools. The findings thereof may not be deemed reflective of all early childhood teachers. The study was limited to teacher factors (training, professional qualification, teaching experience and attitude) as the independent variables. Other variables that could influence choice of inquiry approach were not considered for this study but could be considered in other studies in future. Use of inquiry based instruction forms the dependent variable. The inquiry approaches that were considered included: hypothesizing, experimenting, questioning, and discovery. Other inquiry methods and process skills are important and could form the focus for investigation in other studies.

1.5 Assumptions of the study

This study was guided by the following assumptions. Firstly, that early childhood teachers possessed varied attitudes towards inquiry approach. Teacher’s attitudes were either positive or negative towards inquiry approach. The teachers with positive attitudes may be using inquiry approach while those with negative attitude may not. Secondly, that not all early childhood teachers were conversant with inquiry approach. Lastly, it was assumed that teachers who may be using inquiry approach plan and prepare teaching/learning activities in an inquiry approach.

1.6 Theoretical and conceptual framework

This section presents the theoretical and conceptual framework of the study.
1.6.1 Theoretical framework

This study was founded on Piaget’s (1972) Constructivism Theory. The theory posits that children learn by constructing own understanding and knowledge of the world through varied experiences. A constructivist approach to early childhood education is based on the understanding that knowledge is constructed by children themselves instead of being transferred or transmitted to them. In this approach, children are regarded as theory builders and intellectual explorers. The assumption here is that children develop their own complex and varying theories about the world as they continue to interact with their surroundings. According to the Piaget’s Constructivism Theory, learners take part in the physical construction of knowledge when they engage in active learning. It also adds that knowledge is symbolically constructed by learners who are making their own representations of action. Socially, learners construct knowledge by attempting to convey the meaning of certain information to others. On the other hand, theoretical construction of knowledge can take place when learners try to come up with explanations of the things they do not adequately understand.

Constructivist approach requires teachers to provide supportive and favorable environment where young learners are motivated to go about testing and revising their original theories. Creating such an environment requires first a variety of interesting materials that children can explore and manipulate. Moreover, there should be unstructured time for children to develop and test their own ideas as well as a social climate where children can note that questions and experimentation are as valuable as knowing the right answers. Productive questions posed by the teacher play a significant role in helping children construct their own understandings.
Productive questions are, in fact, one of the most effective tools for supporting constructivist learning. This study sought to investigate the how pre-primary teachers employ constructivist teaching using inquiry.

The rationale for using this theory to support children’s learning using inquiry was based on the fact that the majority of children have difficulty engaging in constructive learning because they fail to make adequate connections that are necessary in arriving at a desired understanding without hypothesizing and questioning as is the practice in early childhood classrooms currently. Piaget’s constructivism theory was further found relevant to this study because it helped the researcher to conceptualize that teachers have to use teaching approaches which enhances their learners' logical and conceptual growth, children should be allowed to construct knowledge by being active participants in learning and investigation as that influences what is learned and the experiences the learner draws upon to construct new understandings, inquiry based learning approach to teaching and learning science may help move learners away from the rote memorization of facts to metacognition and self-evaluation and that teachers level of training on pedagogical imparts on the teachers ability to implement inquiry teaching and learning.

Inquiry-based learning has a strong theoretical foundation in constructivism. Therefore, constructivism theory provided a theoretical framework for the present study to explore and investigate the issues related to current teaching and learning of science and the implementation of inquiry learning by teachers at the pre-primary school level in Meru South Sub County. It is important to substantiate that constructivism is not an instructional approach; rather it is a theory about how
learners construct knowledge. The theoretical propositions emerging from the constructivist theory were of particular relevance to this study as they guided the researcher to describe the complexity of early childhood science teaching by investigating the determinants of use of inquiry based instruction by early childhood teachers’ in teaching science in Meru South Sub-County, Kenya.

1.6.2 Conceptual framework

The relationship between the study variables is diagrammatically shown in Figure 1.1.

![Diagram showing the conceptual framework](image)

**Figure 1.1: Relationship between the study variables**
The conceptual framework illustrates the independent variables that influence the use of inquiry-based instructional approaches in teaching science in pre-primary schools; they are teacher’s level of training, type of training institution and teachers’ experience in the use of inquiry method. The study perceived science activities by learners as a function of teacher related factors. The pre-primary school teacher will utilize his/her academic ability and experience to understand, internalize and construct knowledge. She/he will use his/her training to come up with appropriate methodology for imparting science concepts. The intervening variables subject to influencing both the independent and dependent variables includes class size and school management. Hence the dependent variable is the use of inquiry-based instructional approaches by teachers in pre-primary schools in teaching science.
1.7 Operational definition of terms

**Discovery learning:** Refers to acquiring science skills through hands-on experiences provided in the environment.

**Hands-on:** Activities and real things that children can engage with bodily.

**Hypothesizing:** Refers to suggesting possible explanations and guessing of possible answers to some science questions or observed objects or phenomena based on information held on tentative grounds without knowing whether the explanation or guess is really true.

**Inquiry:** Refers to the methods and approaches that scientists use to study nature and formulate explanations of what has been observed.

**Inquiry based learning:** A strategy of teaching science in which a teacher allows learners to study science based on their own investigation via observation and concrete experiences, hypotheses formulation, designing experiments, performing their own designed experiments, analyzing and discussing their findings and communicating results.

**Level of training:** Refers to the highest educational qualification obtained by a teacher.

**Pedagogical content knowledge:** Refers to knowledge that guides the teachers’
actions and reasoning in highly contextualized classroom settings.

**Problem solving:** Refers to the process of working through details of a problem to reach a solution through trial and error, following links/hints and modeling.

**Regular teaching methods:** Type of learning using direct instructions or direct explanation from the teacher.

**Science activities:** Are activities through which children acquire knowledge and understanding of scientific concepts, as well as comprehending how scientists study the natural world by posing, investigating, and answering questions.

**Simulation activities:** Refers to activities that engage combination of sound, sight, motion and smell to make children feel that they are experiencing an actual situation.

**Teachers’ academic level:** Refers to the highest level reached in formal relevant to early childhood science.

**Teacher’s experience:** Refers to the number of years of classroom experience in teaching early childhood science.

**Teacher factors:** Refers to Teachers’ academic level, training and years of science teaching experience in early childhood classrooms.

**Type of training institution:** Tertiary or university institution where a teacher underwent training.
CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Introduction

This chapter provides an account of the literature reviewed on instructional approaches used in science teaching in early childhood education with a focus on inquiry approach. The reviewed literature mainly from primary and secondary sources and journals is presented through a discussion of the following aspects: Inquiry based approach and its contribution to science learning, inquiry instructional approaches in science teaching and determinants of teachers’ use of inquiry based instructional approaches.

2.2 Inquiry based approach and its contribution to science learning

Inquiry-based instruction refers to the use of hands-on activities in enabling children explore the scientific concepts with the aim of generating process skills that are necessary for deeper understanding of the scientific ideas. Historically, science instruction was carried out based on a philosophical approach where the minds of students were exercised through rote memorization of the information. It was until 1960s when researcher Jean Piaget and his team began to discredit this approach of science instruction (Schweisfurth, 2011). Some of the philosophies and approaches of learning styles and learning environments that were developed were founded on the assumption that learners do actively engage in the construction of their own individual perspectives on the world based on personal observations and experiences (Tatar, 2006). In particular, Piaget’s study recommended that positive learning environments should promote physical experiences more than anything else for the benefit of the children. This research also showed that involvement in learning is the
essential to intellectual development, especially during their earlier years of schooling. Subsequent researches have also indicated that science instruction needs to emphasize on the direct physical manipulation of objects, equipment and materials for it to be effective (Schweisfurth, 2011). The experiential learning that takes place in elementary schools provides a strong foundation that is required for the development of abstract thinking later in life. The use of inquiry-based instruction plays a vital role in helping children improve their reasoning abilities as well as providing experiences that enhance the early stages of cognitive development. As Wang (2011) notes, it is rare to find out that the learning activities used in elementary classrooms enabling children to undertake a process and derive their own hypothesis or conclusion about a phenomena. Although extensive researches have been conducted on the teachers’ ability to implement inquiry-based instruction, the available literature (Tahir & Ullah, 2010; Nazir, 2006; Ali, 2007) does not adequately examine the inquiry-based science teaching in pre-primary classrooms due to the fact that such practices are particularly limited in these settings. In most cases, people tend to use the direct instructions. This study aimed at examining the inquiry-based practices of pre-primary teachers in order to inform the science education community on the complexities that exist when teaching young learners through inquiry.

It is worth noting that the inquiry-based programs are dynamic in nature and hence depict science as an ongoing process of exploration and discovery, rather than a content domain to be memorized (Brigham, Scruggs & Mastropieri, 2011). Most science concepts require inquiry-oriented instruction since it engages students in the investigative nature of science thereby facilitating deeper understanding. Major
process skills such as data recording and measurement are usually covered in
textbook-based programs, but the higher level process skills of predicting, inferring,
hypothesizing, experimenting and controlling variables can only be realized through
activity-based experiences (Brigham, Scruggs & Mastropieri, 2011). In essence, the
inquiry-based teaching encourages learners to conduction their own investigations
before responding to science questions. These questions can effectively be answered
once the learners have clearly constructed mental frameworks that relate to what
they have learnt and thus explain their direct experiences. Surprisingly, a strong
body of evident suggests that the majority of pre-primary school teachers are not
interested in the use of inquiry approaches in their science classrooms. This became
the foundation of this study that sought to investigate whether teachers level of
training, experience and type of training institution had an influence on effective use
of inquiry based learning approaches in teaching science in pre-primary schools.

2.4 Inquiry based instructional approaches in science teaching

According to Sullican (2008), inquiry-based instruction is simply using hands-on
activities in teaching children so that they are able to explore scientific concepts,
as well as instruction in which the focus is on using process skills to gain. However,
inquiry method guides children in using an analytical approach to understand their
world and construct new knowledge (Kennedy, 2013). When children fail to engage
in an inquiry learning process, they are likely to experience limited and narrow
development of problem solving skills. As Tatar (2006) contends, inquiry-based
learning gives children the opportunities to harness skills they will require in their
entire lives as well as learning to cope with problems that may not have clear
solutions. It also allows them to deal with challenges of understanding and guide their search for solutions, now and in the future.

Studies have shown that an inquiry based, learning approach is the best way to teach science. Koray, Köksal, Özdemir and Presley (2007) argues that despite the importance of using inquiry in teaching science to children, majority of early childhood teachers still use a textbook-based, content-acquisition approach to science education. However, this does not imply that these textbook-centered programs do not involve any hands-on activities. This study investigated how teachers in pre-primary schools used inquiry methods in teaching science.

A variety of inquiry based teaching methods have been emphasized in literature. Such includes engaging learners in hypothesizing. Martin, Sexton, Wagner and Gerlovich (1997) defines a hypothesis is “an idea or suggestion that is based on known facts and is used as a basis for reasoning or further investigation.” Hypothesizing employs scientific concepts and has the purpose of seeking to provide general explanations about how the world behaves. This study measured the number of times a teacher encouraged children to hypothesize during science activity lessons in pre-primary school classrooms.

Studies have also indicated that science instruction needs to consist of direct physical manipulation of objects, equipment and materials to be successful (Correiro, Griffin, & Hart, 2008). Inquiry-based instruction that uses simulative activities enable to improve their abilities to reason and provide experiences that enhance the early stages of cognitive development (NARST, 2011). Giving children direct contact with scientific investigations is an efficient way of equipping them with skills that will prove to be essential in the rapidly changing technological world.
Children are likely to understand the physical world better when they work directly with natural phenomena, acquiring new their knowledge as they go along as opposed to obtaining it only through print material (Diggs, 2009).

Research in Kenya has failed to look at the use of inquiry approaches such as use of simulation activities especially at the ECDE level (Ongosi, 2007; Majanga, 2011 & Atieno, 2013). This implies that the problem of negative attitude towards science at other levels of education may probably be lying in the lack of employing inquiry learning approaches at pre-primary level. This study therefore investigated teachers’ use of inquiry based instruction in teaching science in pre-primary school classrooms in Meru South Sub County, Kenya.

Problem solving is the foundation of a young child's learning (Abrams, Southerland, & Silva, 2008). It must be valued, promoted, provided for and sustained in the early childhood classroom as a means of promoting inquiry (Abd-El-Khalick et al, 2004). Instances that require problem solving are commonplace in everyday life of a child. Close observation of a child can help the teachers analyze the child's social, cognitive, movement, and emotional experiences to promote strategies that can prove to be useful for him or her in the lifelong process of learning. Asghar (2011) asserts that, asserts that children are able to formulate and practice ideas to decide whether they accept or reject what they learn after exploring social relationships, manipulating objects, and interacting with people.

Krajcik and Sutherland (2010) assert that the preferred pedagogical method for teaching science effectively in early childhood is an inquiry-based instructional approach that encourages problem solving. Moreover, science education researchers
Brigham, Scruggs and Mastropieri (2012) have demonstrated empirical evidence supporting that position. Inquiry-oriented instruction engages learners in discovery learning which means finding out or seeking to come up with knowledge to problem solve. Problem solving learning is an approach in which learners develop knowledge in their working memory by engaging in appropriate cognitive processing of mental representations during learning. This type of instructional method should be embraced in teaching science in early years of child development.

Inquiry-based learning is increasingly becoming popular in science education, with a growing number of educators becoming interested in teaching which involves inquiry approaches such as active questioning (Asay & Orgill, 2010). To be effective, inquiry learning should make use of the basic abilities of carrying out a scientific investigation as well as mastering of how scientists do their work (Mayer, 2008). Inquiry-based learning should put more emphasis on learning the processes of science, such as formulating empirically sound questions and managing to support the claims with solid evidence. Substantial research supports the efficacy of questioning as an instructional model. This study sought to investigate how teachers in pre-primary schools in Meru South Sub County engaged children in formulating empirically investigable questions.

The purpose of learning science through allowing children to question is premised on the fact that questions arouse interest and curiosity concerning the issue under investigation and focus learners attention on a particular concept (Capps & Crawford, 2012). Reasoning questions can stimulate children to think and organize their thoughts (Capps et al., 2012). Prediction questions on the other hand encourage creativity, help children to hypothesize and prompt investigation thus enhancing
children’s problem solving skills (Berland & Reiser, 2008). Findings by Huber and Moore (2001) support these sentiments. Kazempour (2009) contends that teachers were rarely allowing children to be inquisitive. Instead they continue to promote fact memorization with little or no engagement of children in questioning. Because of this, children do not develop probing skills necessary for social competence in life. This study sought to find out the how teachers encouraged learners to question during science activities.

2.5 Determinants of teachers’ use of inquiry based instructional approaches

Several factors may positively or negatively influence the use of appropriate approaches among early childhood teachers. The factors could include; teacher’s knowledge of the subject, teacher’s academic qualification, teacher training and experience.

2.5.1 Teacher’s training

Teacher's training is an important component in implementation of any new curriculum. Through training, teachers who are considered mentors of any society are prepared and produced (Republic of Kenya, 2008). There are many factors that affect the implementation of a school curriculum. As Orodho (2013) notes, training of teachers either pre-service or in-service is one of the factors influencing curriculum implementation. Pre-service refers to the training of teachers on a certain curriculum before they embark on their teaching career. On the other hand, in-service is where teachers are trained how to implement a particular curriculum when they are active in practice. Given their importance of curriculum implementation, teachers need adequate training to be able to handle a new pedagogy including inquiry (Jacob, 2011). This study therefore investigated how teachers’ level of
training influences use of inquiry based instructional approaches in teaching science in pre-primary schools.

Teachers are vital human resource in the teaching and learning process therefore requires critical consideration (Banchi & Bell, 2008). Teacher trainees in colleges and universities are equipped with skills (the art or pedagogy) of teaching (Wanjala, 2008). This implies that after undergoing training one becomes an authority in his or her field of operation. Even with the highest professional qualification possible, teachers should always strive to improve their skills and knowledge. The present-day programmes for teacher education in Kenya aims at providing qualified teachers and hence are vital in ensuring the promotion of better teaching methods.

Kilgallon and Maloney (2008) argue that lack of training in the use of inquiry poses a challenge in the teaching of science in pre-primary school. Use of inquiry requires the introduction of the method whose success will depend very much on the in-service and pre-service training in teacher training colleges (McLinden & Edwards, 2011). Normally, training is designed, developed and administered with the goal of conforming to a particular system of education (Kafu, 2011). These studies not only provide insight into the characteristics of good teachers, but also reveal how this contributes to learners learning and closing achievement gap. Hence professional training of pre-primary school teachers in the implementation of science activities was investigated in this study.

Advocates for early childhood are drumming up their support for a legislation that would see teachers of children below age of five should have at least an undergraduate degree in early childhood education or valid certification to enable them teach this groups of learners effectively (Whitebook & Ryan, 2011). Trained
teachers with higher level professional qualifications may have more exposed to varied content or teaching methods. However, Karugu (2007) contend that teacher education or training is not always consistently related to higher quality classrooms interactions or better academic skills for children.

Research conducted by Karugu (2007) in Kenya revealed that only 80% of science teachers were qualified that is professionally trained he says that problem of teachers can be improved by advancing in education. He says a well-trained teacher feels motivated to teach. The teachers who are not motivated always feel that the syllabus is wide and difficult to finish in time. Therefore, training in the use of inquiry is crucial in preparation of teachers to teach science at ECDE level and can play a major role in shaping the teacher's perception. Teachers who may have insufficient training support in inquiry may get frustrated and turn against it. This study

Allinder (1995) examined the relationship between teachers’ training and effects of personal and teaching efficacy of teacher’s use of Curriculum Based Management (CBM) and its effects on student’s achievements were studied. Nineteen special education teachers each monitored two elementary school students with mild disabilities over sixteen weeks in Math computation using CBM. The report indicated that teachers with high training more often increased student’s end-of year goals. This study sought to investigate the effects of teachers’ level of training on use of inquiry based instruction in teaching science in early childhood.

In Kenya, the training of teachers in the area of early childhood education normally attract trainees with poor academic achievements. Until 2002, early childhood education had the lowest academic qualification requirements with a minimum of 15 points in CPE or its equivalent KCPE or a division four in KCE or grade D [Plain]
in KCSE (Republic of Kenya, 2000). After ministerial review, these qualifications were raised to the current requirement of a minimum of a D+ [Plus] in KCSE. However, for the international educational standards, this requirement is still very low considering the fact that the quality of early childhood education depends on the academic abilities of a particular teacher. It is not therefore surprising that the preschools in Kenya have been realizing poorly educated children to the primary schools. The cadre of teachers who practice early childhood education are rated by the society as academically dwarfs and hence considered low performers as their profession is not ‘expected’ to require highly qualified people. Academic qualifications have a positive correlation with the teachers’ performance in classroom teaching. Kiragu (2007) adds that trained teachers do make a difference and there work can stand out among the rest of untrained low-qualified teachers.

The level of relevant training also plays a role in determining the teaching method that the majority of teachers prefer. Early childhood teachers in Kenya may not be getting adequate training as most of their educational programmes are undertaken during school holidays often hurriedly and shallowly as the aim is to complete session units. A case in point is the widespread school based programmes offered in various universities and colleges. This reinforces the asserts of Feunema and Franke (1992) that most early childhood teachers do not get the requisite training to allow them to use inquiry approach effectively.

This investigated whether training as a factor influenced teachers’ use of inquiry based learning approaches in Meru South Sub County in Tharaka-Nithi County, Kenya.
2.5.2 Type of training institution

An instructor’s choice of pedagogical method influences the learning goals that learners can accomplish (Rothwell & Kazanas, 2008). Appropriate teaching methods and strategies can considerably contribute to proper learning making the teacher more effective and efficient. In this study, therefore, the researcher explored the extent to which type of training institution influences teachers use of inquiry based instructional approaches in teaching science in early childhood development education centers.

In a study on the factors influencing the choice of approaches used by pre-school teachers in Baringo County, Kenya, Rotumoi and Too (2012) found that the training institution that a teacher attended determined the types of approaches that one found confortable to use in teaching. In Kenya, The training colleges for teachers usually promote rote learning where a learner focuses on recalling and memorization of information for the sake of passing final examinations administered by KNEC. This type of learning can be attributed to the fact that in Kenya, a person is regarded as qualified based on what he or she scored in the final examinations rather than the extent of actual knowledge in a specific subject. Sadly, the pre-service curriculum and examination policy have remained relatively unchanged for decades despite not fostering active learning methodologies. Similarly, this could be as result of the resource constraints either in terms of finance or personnel available for these training institutions. This study sought to determine how the type of training institution influences use of inquiry based instructional approaches in teaching science in pre-primary schools in Meru South Sub County.
It is important to point out that teacher educators employed in the teacher training colleges are not in the first place qualified enough to work as primary school teacher educators due to the lack of professional training in that particular area. Most of them are just subject specialists who recruited or re-posted directly from secondary schools with no prior experience in teaching primary school children or specialized knowledge of the professional area of primary school education. As a result, they are unable to make relevant connections between the knowledge they are teaching and how to teach this to student teachers who are mainly training for early childhood education. As DuPlessis and Irfan (2010), maintains there is lack of pedagogical content knowledge used in teacher education. This combines subject matter knowledge with relevant primary school methods.

Kangori (2014) adds that educators in teacher training institution mainly focus on the content coverage while ignoring the concept of pedagogical content knowledge. The concept of pedagogical content is critical in both knowledge acquisition and practice of a good primary teacher as well as a teacher educator in college. An effective education for a teacher is not just about having a strong understanding of the subject to be taught (content knowledge), but also being able to embrace a set of abstract teaching strategies (pedagogical knowledge) (Richey, Klein, & Tracey, 2011). Pedagogical content knowledge normally encompasses ideas on how to teach a particular subject and hence facilitate the development of abstract skills. For instance, it can be through structuring the content and use methods in teaching that make sense for particular learners. Moreover, it can include the abilities of detecting why certain topics are easy or difficult to comprehend or learn how to represent concepts and processes of a topic and what strategies to use to help learners gain
understanding of content (Kumar & Vigil, 2011). Based on the baseline survey conducted by Teacher Education Professional Development (TEPD) in 1986, there is little to show that teacher educators in Kenya effectively use pedagogical content knowledge or include it in preparations on teaching. This is a critical gap in the teacher education curriculum and programme.

As Chabalengula and Mumba (2013) and Schulman (1986) jointly suggested that there are some situations, which affect the choice of the methods to be used in teaching. Factors such as the physical environment, class level, curriculum, social economic background of the student, students’ individual differences, and teacher personal problems influence the approaches used in teaching. Surprisingly there is no mention of whether the type of training institution has an influence on the methods used in teaching science. This is a gap in knowledge that this study sought to fill.

A study by Bramald, Hardman and Leat (1995) did not establish a positive link between the type of training institution and use of inquiry based instructional approaches in teaching science. The study showed that the type of teacher training institution had no significant impact on the teachers’ classroom behaviour, this being negatively correlated with use of inquiry approaches. Clotfelter, Helen and Jacob (2007) found a positive and significant relationship between the prestige of the undergraduate institution and productivity of high school teachers. It may be summed up that there are certain teachers’ characteristics that may affect the choice of teaching methods; however, the mixed findings of Bramald, et al. (1995) and Clotfelter, et al. (2007) provided a research gap that this study sought to fill.
2.5.3 Teaching experience

Studies on the effect of teachers' experience on students' learning have found a direct relationship between teachers' effectiveness and their years of experience, but the relationship observed is not always entirely linear one (Buddin & Zamarro (2009). Available evidence suggests that when experienced teachers are less effective than more senior teachers, the benefit of experience level fades off after a few years (Rivkin, Hanushek, & Kain, 2000).

Timmerman (2004) established that education background and experience in a subject affect the teachers’ teaching methods. If teachers are directly involved in various teaching methods and seek personal experience, then they would have knowledge on the most effective techniques to use these tools in their classrooms. Research by Ndegwa (2005) and Ng’asike (2004) suggests that teacher experience can either have a exert significant or insignificant impact on an individual depending on what exactly has been acquired or encountered earlier and how one is poised to apply it to new learning. As widely accepted across the board, experience promotes efficiency. This study investigated the influence of teachers’ teaching experience on use of inquiry approach in science teaching in pre-primary schools.

Many occupations recognize employees’ years of experience as an important requirement in human resource activities. Similarly, teacher experience is a cornerstone of productivity in the education sector. Based on the assumption that experience promotes effectiveness, Ladd (2008) argues that the impact of experience is can only be felt during the first few years of teaching after which it follows the law of diminishing returns. However, Harris and Sass (2007) established that teachers with more than twenty years of experience are more effective compared to
teachers with no experience, though this does not apply to those with five years of experience. Despite the advantages of early-career experience, classroom efficiency of experienced teachers compared to that of little or no experience varies widely in the practice of teaching science subjects. Research on the impact of teacher experience on teaching using inquiry at the pre-primary school level is less encountered. Therefore, this study purposed to examine whether years of experience in teaching science affected the overall choice and use of inquiry based learning approaches among teachers in pre-primary schools in Meru South Sub County.

2.6 Summary of literature review

The education level and experience of a teacher are the primary attributes of teacher quality have been the focus of various studies in the recent past. However, results of existing empirical studies examining the relationship between the use of inquiry-based learning approaches and both teacher education level (Ladd, 2008; Harris & Sass, 2007). The existing literature, therefore, leaves three important questions unanswered: how does science teacher education level, experience and type of training institution influence use of inquiry based instruction in teaching science in pre-primary schools? To address these questions, this study examined the joint effect of type of training institution, level of teacher training and experience on use of inquiry based instruction in teaching science in pre-primary schools.
CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

This chapter presents key issues that are pertinent in framing a solid methodological argument important for this study. These issues are addressed through discussions of the following aspects: research design; variables, location, and target population of the study; sampling techniques and sample size, instruments of research, pilot study, collection and analysis of data, as well as logistical and ethical considerations.

3.2 Research design

The study employed an in-depth descriptive research design using survey and observation method in an investigation of determinants of early childhood teachers’ use of inquiry approach as a method of instruction and the factors that could be relating to its use in Meru South Sub County. An in-depth descriptive research design is considered appropriate for the study because it enabled the researcher to be able to gather in-depth information concerning the teacher related factors influencing teachers practice. This study adopted this design because the researcher did not envisage actual control of independent variables but systematic procedures were employed to collect and analyze data.

3.2.1 Variables of the study

The independent variables used in this study were:

1. Teachers’ level of training: - Taken in this study to mean the highest educational qualification obtained by a teacher was measured by asking the teachers to state the highest certification earned excluding information such as
courses undertake and grades attained. The effect of teacher level of training (education) was assessed by establishing the teacher's undergraduate or graduate major and the highest certification achieved. Three levels of training (certificate, diploma and degree) were evaluated. Many researchers have noted that the teachers’ level of training is a good predictor of that teacher’s use of teaching methods. Teachers who, for instance, are college educated may be better equipped to engage in inquiry than those who have less than a high school education, other things being equal. Thus, establishing how teachers’ level of training imparted on use of inquiry based learning approaches was vital.

2. **Type of training institution:** - The institutions for ECDE teacher training in Kenya include private and Public Teacher Training Colleges, DICECE centres and Universities. This was measured by asking the participants to indicate whether they trained from a Private or Public Teacher Training College, DICECE training centre or University. This enabled the researcher to evaluate whether type of training institution does make a difference in teachers use of inquiry. The measure also enabled the researcher to establish which type of training institution had the best effect on teachers’ use of inquiry.

3. **Teaching experience:** - Each participant was asked to state the number of years of teaching science at pre-primary level. The teachers’ frequency of engaging children in inquiry learning was then compared with their teaching experience in order to understand the cohort’s experience of incorporating inquiry instruction into their teaching.

The dependent variable was use of inquiry based approach. This was measured by observing the frequency of use of the following strategies during teaching:
a) Exploring objects, materials and events;
b) Raising questions,
c) Making careful observations,
d) Engaging in simple investigations,
e) Describing (including shape, size, number),
f) Comparing, sorting, classifying and ordering;
g) Recording observations using words, pictures and drawing,
h) Using a variety of simple tools to extend observations,
i) Identifying patterns and relationships,
j) Developing tentative hypothesis, explanations and ideas,
k) Listening to new perspectives.

3.2.2 Research methodology

Qualitative approach was considered the most appropriate approach for this study first because it focuses on a descriptive and inductive study of people's meanings and understandings of their own realities. The qualitative approach emphasizes grounded practice derived from a rich descriptive data. Secondly, Bogdan and Biklen (1992) argue that the qualitative research's goal is to better understand human behavior and experience. The qualitative data collection methods employed included interview and observation of science lessons.

3.3 Location of the study

The study was carried out in Meru South Sub County in Tharaka-Nithi County. The choice of the study location was based on the education problem that the teaching and learning of science at the pre-primary level in the area was majorly exam-oriented with main focus on rote learning rather than inquiry-based instruction. The
researcher noted that activities-based learning was rarely used. This is rather unfortunate because teaching science put more emphasis on child-centered approaches so that young learners can easily develop scientific skills, knowledge, and values. The implication is that the manner in which science teaching was currently being conducted in pre-primary schools in Meru South Sub County could be a precursor of poor pupil performance in the subject at national examinations. This compelled the researcher to choose the study locale. Furthermore, there was no evidence of a similar study conducted in the area.

3.4 Target population
The target population for this study was 270 teachers in 90 public pre-primary schools handling 3 to 5 years old children.

3.5 Sampling techniques and sample size
In this section the researcher presents the sampling methods used to obtain the respondents for the study.

3.5.1 Sampling techniques
The researcher followed the following steps to obtain the respondents for this study:

**Step one:** The researcher briefed the head teachers from each zone in Meru South Sub County on the intended study. The researcher requested the head teachers to provide a list of teachers handling the pre-primary section in their schools.

**Step two:** The researcher used homogeneous sample selection (that is select a small and homogeneous case or set of cases for intensive study). Three teachers from each zone were purposively selected. The primary goal of using purposive sampling in qualitative research is to obtain information rich cases. Baker and Edwards (2012)
argue that in qualitative studies researchers can sample uniformly from a study population without need for a proportionate distribution.

Creswell (2013) contends that qualitative researchers tend to rely on very small samples of participants typically 18 to 25 in qualitative studies which can be obtained using uniform sampling. Douglas (1985) supports the use of few respondents in phenomenological studies as the exercise is rigorous and a lot of time is involved. The sample for this study consisted of 18 teachers considered key informants. The justification for the sample being rather too small was based on the fact that the process of data collection involved prolonged engagement in the field that entailed observing each teacher in 3 science lessons of 30 minutes at different times totaling to 90 minutes and conducting interview with each participant lasting 30 minutes. Table 3.1 shows the sampling frame and sample size.

### 3.5.2 Sample size

The sample for the study was as shown in Table 3.1

**Table 3.1: Sampling frame and sample size**

<table>
<thead>
<tr>
<th>Zone</th>
<th>Total number</th>
<th>Teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number in the sample</td>
<td></td>
</tr>
<tr>
<td>Kiang’ondu/Karingani</td>
<td>45</td>
<td>3</td>
</tr>
<tr>
<td>Mugwe/Kithangani</td>
<td>57</td>
<td>3</td>
</tr>
<tr>
<td>Mwonge/Rubate</td>
<td>39</td>
<td>3</td>
</tr>
<tr>
<td>Magumoni</td>
<td>36</td>
<td>3</td>
</tr>
<tr>
<td>Kajuki/Mutino</td>
<td>54</td>
<td>3</td>
</tr>
<tr>
<td>Kamwimbi</td>
<td>39</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>270</strong></td>
<td><strong>18</strong></td>
</tr>
</tbody>
</table>

### 3.6 Research instruments

The study employed an interview and observation schedule to collect data.
3.6.1 Interview guide

An interview guide was developed to ensure the researcher remained focused on the study variables. The interview questions were divided into two sections namely: section A that sought teachers details such qualification and experience among other, section B sought reports from teachers regarding practicing inquiry-based instruction in their classrooms and identified factors related to the use of inquiry. Interview was considered appropriate for this qualitative study as it focused on a descriptive and inductive study of people's meanings and understandings of their own realities.

3.6.2 Observation guide

This tool guided the researcher to seek information on how teachers executed science lessons. This entailed observing teachers as they taught science in order to find out their frequency of using inquiry based instructional approaches. According to Alvesson and Sandberg (2013), observation can act as a significant source of information that can supplement the data that is collected using other methods like interviews.

3.7 Pilot study

The interview questions were administered to teachers in two schools in Maara Sub-County purposively selected to check content and face validity of the interview schedule. Four early childhood teachers handling pre-unit classes in the identified schools were observed in two science lessons and then later after one week interviewed for about 30 minutes. The purpose was to test the appropriateness of the items in the instrument with the objective of improving them in order to enhance validity and reliability.
3.7.1 Validity of the research instruments

In qualitative research, validity is about determining whether the research accurately measures intended variables and how precise an instrument of measurement is when performing its tasks (Denzin & Lincoln 2005). Thus, the researcher established content validity by seeking expert judgment from the research supervisors and qualitative research experts in the Department of Early Childhood Studies of Kenyatta University. The experts examined the observation and interview guides individually and provided feedback. Their recommendations were incorporated in the final interview schedule. These helped in ascertaining the credibility, dependability conformability and clarity of the instruments.

The researcher also attempted to increase the validity of responses by ensuring that the respondents had a clear understanding on the purpose, nature, field, and procedures of the study. Majority of the respondents were also interviewed more than once to establish that there was consistency of information so that the research can keep accurate information or notice the variation in the responses over time.

3.7.2 Reliability of the research instruments

In qualitative research, reliability is refers to the consistency, stability and repeatability of the information provided by a specific respondent. Reliability also extends to investigators’ ability to collect and record information accurately over repeated testing periods under a similar methodology (Winter, 2000). To ensure reliability in qualitative research, Denzin and Lincoln (2005) recommend use of specific strategies such as member checks, peer review, prolonged engagement and persistent observation.
Several measures were employed to increase the reliability of study. For instance, all interviews were recorded to serve as reliable evidence and reference in the course of the study as well as avoiding any bias that would occur when the research attempts to recall the information. Furthermore, frequent debriefing sessions between the researcher and the supervisors were done. Participants’ were given freedom to elaborate their opinions during interviews; the researcher had prolonged engagement with the participants. This helped in building participants trust and rapport so that participants felt comfortable in disclosing information. The researcher also checked out bits of information across informants. This enabled the researcher to corroborate participants’ responses at all stages of the research process. The researcher invited respondents to read transcripts of dialogues in which they had participated. The emphasis was on whether the respondents considered that their words matched what they actually intended or said during interview. In addition, reliability of the research instrument was ascertained using inter-observer technique. This evaluated the degree to which different raters or observers gave consistent answers to the research questions.

3.8 Data collection techniques

The researcher randomly selected and observed three science lessons taught by each teacher. The researcher did not influence the teaching environment in which the lessons were taught. To minimize on the observers effect, the researcher avoided interrupting the normal running of the school by observing the lessons as they appeared on the time table. Further, the researcher entered the classrooms with the teacher to avoid interrupting the lesson in any way and sat at the back of the classroom from where the researcher observed and recorded the lesson proceedings.
in a note book. During observations of lessons taught, the researcher focused on the following areas:

1) How often the teacher engaged children’s everyday knowledge in science instruction.

2) How the teacher made scientific concepts clear to the learners.

3) How the teacher maintained a balance between direct instruction and inquiry activities.

4) Frequency the teacher encouraged children to learn science using inquiry learning approaches.

After observation of lesson, the researcher personally interviewed all the respondents. Interview with each respondent lasted approximately 30 minutes. The whole data collection exercise took a period of six months.

3.9 Data analysis

Given the nature of this study, qualitative data was collected, recorded and continuously analyzed throughout the data collection phase. The purpose for doing this was to empirically examine the relevant elements of this study to identify patterns, themes and relationships among the study variables. The field notes and interview transcripts were analyzed for each respondent and then compared with others. The instructional themes analyzed were then condensed into descriptive categories. The research used the comparative method to find data on recurring themes or events. Interviews and teacher observations during teaching of science lessons helped in the identification of recurrent patterns and themes. All the data was categorized with close attention to diversity of the sources and nature. There was a regular and consistent comparison of the categories throughout the entire data
analysis phase of the study. The representation of themes was done through the use of inquiry assertions and core conceptions. There was consistent reassessment and verification of the responses.

Accordingly, the following eight qualitative content analysis steps were employed in this study:

1. Reading through all the transcripts to extract the responses.
2. Selecting the transcript which has the most relevant and information.
3. Clustering similar topics together to form major topics.
4. Abbreviate topics as codes and determine emerging categories.
5. Developing categories by grouping interrelated topics together.
6. Arranging each category by constructing interrelated themes.
7. Evaluating categories with interrelated themes for relevance to the research questions and research aims.
8. List categories with interrelated themes according to the research objectives and the identified categories with constructed themes used as basis for answering the postulated research questions.

The identified categories with constructed themes were used as basis for answering the postulated research questions.

3.10 Logistical and ethical considerations

Research involves collecting data about a given subject directly from the real world. This section includes information on Logistical and ethical considerations when people are involved as participants in research.
3.10.1 Logistical considerations

The researcher obtained a research permit from the National Commission for science, Technology and Innovations (NACOSTI). Before administering the instruments, permission to carry out the study in public pre-primary schools in Meru South Sub-County was sought from the Sub-County Director of Education. Head teachers of the schools that were selected to provide teachers who participated in the study were consulted to allow the study to be carried out in their schools.

The researcher booked appointments with the respondents and had familiarization visits during which the researcher requested teachers to provide their time tables. This enabled the researcher to prepare a visitation schedule to the schools. To avoid the teachers making any specific preparations, no special appointments were given. The familiarization visits was a crucial stage in this study because it was during this time that the researcher obtained teachers consent and established working relations with the respondents. The head teachers of the schools were contacted before the teachers were observed and interviewed.

3.10.2 Ethical considerations

Before the commencement of the study, the research provided a thorough explanation on the purpose of research to the head teachers and teachers. All participants volunteered to take part in the study and were assured of their confidentiality and privacy. They were also required to fill an informed consent form as a proof of their acceptance and availability for the interview. The respondents were encouraged to maintain their anonymity so that they are rest assured that their information shared can lead to future consequences. The researcher provided accurate and adequate information reading the procedures and
methods of research that were to be followed as well as the benefits of participating in the study.

The researcher also paid close attention to the willingness and readiness of the participants to share credible information without any form of coercion. After obtaining the consent from the participants, the researcher urged the participants to feel free to express their discontent anytime they feel like as well as withdraw from the study when they wished to do so. This was done to ensure that the information shared comes from a willing participant whose main objective is to provide credible information that can assist the research to make accurate and reliable deductions on the topic of study. The names of people, places, and institutions were coded as suggested by McMillan and Schumacher (2006) to enhance impartiality.
CHAPTER FOUR

DATA PRESENTATION, INTERPRETATION AND DISCUSSION

4.1 Introduction

Data for this study was collected using interviews and observations of science lessons. In this chapter the researcher presents the findings, discussion and interpretation of the findings on the following objectives:

i) To establish how teachers used inquiry based instructional approaches in teaching science in pre-primary schools.

ii) To investigate how teachers’ level of training influences use of inquiry based instructional approaches in teaching science in pre-primary schools.

iii) To determine how the type of training institution influences use of inquiry based instructional approaches in teaching science in pre-primary schools.

iv) To examine how teaching experience influences use of inquiry based instructional approaches in teaching science in pre-primary schools.

4.2 Demographic information of participants

This study sought demographic information of the respondents which included teachers’ gender, professional qualification and teaching experience. The results obtained were tabulated in terms of frequency and percentages and are as shown in Table 4.1.
Table 4.1: Demographic information of the participants

<table>
<thead>
<tr>
<th>Teachers biodata</th>
<th>Frequency (n= 18)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>3</td>
<td>17.0</td>
</tr>
<tr>
<td>Female</td>
<td>15</td>
<td>83.0</td>
</tr>
<tr>
<td>Professional qualification</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Degree in ECDE</td>
<td>1</td>
<td>6.0</td>
</tr>
<tr>
<td>Diploma in ECDE</td>
<td>5</td>
<td>28.0</td>
</tr>
<tr>
<td>P1 Certificate</td>
<td>4</td>
<td>22.0</td>
</tr>
<tr>
<td>Certificate in ECDE</td>
<td>6</td>
<td>33.0</td>
</tr>
<tr>
<td>Untrained</td>
<td>2</td>
<td>11.0</td>
</tr>
<tr>
<td>Teaching experience</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 2 years</td>
<td>2</td>
<td>11.0</td>
</tr>
<tr>
<td>2-5 years</td>
<td>5</td>
<td>28.0</td>
</tr>
<tr>
<td>6-10 years</td>
<td>7</td>
<td>39.0</td>
</tr>
<tr>
<td>11-15 years</td>
<td>2</td>
<td>11.0</td>
</tr>
<tr>
<td>More than 15 years</td>
<td>2</td>
<td>11.0</td>
</tr>
</tbody>
</table>

A total of 18 teachers were observed and interviewed of which majority (83.0%) were female while 17.0% were males. This revealed that there was gender imbalance in composition of teachers in pre-primary schools in the study area in favour of females. This implies that male teacher role models were inadequate. Therefore head teachers, should consider employing more male teachers in this sector.

The results further shows that except 89.0% of the teachers in the study sample were professionally qualified with majority 33.0% of them having certificate in ECDE, 28.0% with diploma in ECDE, 22.0% with P1 Certificate and 6.0% with a bachelor degree in ECDE. The rest 11.0% were untrained (had form four level of education) engaged to teach in pre-primary schools due to teacher shortage. From the results it can be seen that most of the teachers in the study sample were professionally qualified which is a positive indication. This places the pre-primary schools in Meru South Sub in a particularly good position in terms of capacity building (skills and knowledge) and creates a better basis for implementing inquiry based instruction.
From the data shown in Table 4.1, it can be seen that 39.0% of the teachers in the study sample were found to have a teaching experience of between 6 and 10 years. Another 28.0% had 2-5 years of experience, 11.0% had between 11 and 15 years. Those who were found to have a teaching experience of more than 15 years accounted for 11.0% too while another 11.0% had taught for less than 2 years.

4.3 Teachers’ use of inquiry based instructional approaches

The first objective of this study was to establish how teachers used inquiry based instructional approaches in teaching science in pre-primary school. Classroom observations constituted the primary source of data. The findings obtained are summarized in Table 4.2.

Table 4.2: Number of teachers that used inquiry based instruction

<table>
<thead>
<tr>
<th>Inquiry based instruction</th>
<th>Untrained n=2</th>
<th>PI trained n=4</th>
<th>Private ECDE n=5</th>
<th>DICECE n=6</th>
<th>University n=1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allowing children to explore objects and materials</td>
<td>2</td>
<td>2</td>
<td>5</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Asking and allowing children to ask questions</td>
<td>2</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>Allowing children to do simple experiments</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Record observations using words and drawings</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Using a variety of simple tools to do investigations</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Allowing children to describe, compare, sort, classify and order</td>
<td>0</td>
<td>1</td>
<td>4</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>Helping children to identify patterns and relationships</td>
<td>0</td>
<td>1</td>
<td>4</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>Encouraging children to develop tentative hypotheses</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Guiding children in sharing and discussing of ideas</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Having children listen to explanations</td>
<td>2</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td><strong>Mean</strong></td>
<td><strong>0.8</strong></td>
<td><strong>1.30</strong></td>
<td><strong>2.6</strong></td>
<td><strong>3.20</strong></td>
<td><strong>0.60</strong></td>
</tr>
<tr>
<td><strong>SD</strong></td>
<td><strong>1.03</strong></td>
<td><strong>1.57</strong></td>
<td><strong>2.32</strong></td>
<td><strong>2.90</strong></td>
<td><strong>0.52</strong></td>
</tr>
</tbody>
</table>
From the findings, it is evident that most of the teachers allowed children to explore objects and materials, asked and gave children opportunity to ask questions during their teaching of science in ECDE. It can also be seen that teachers gave children opportunity to record observations using words and drawings. Apart from the untrained teachers, the rest provided children with opportunity to describe, compare, sort, classify and order materials and specimens, helped children to identify patterns and relationships among things (one teacher prepared slices of fruits derived from different plants. Children were required to sort the fruits according to three concepts (colour, texture and smell) the teacher asked “how do you know that these go together?” In response the pupils said “because they have the same colour”. The teacher prompted them to think about what they were doing. During observation it was established that most of the teachers gave children opportunity to listen to explanations and guided them to think about what they learnt about the concepts and summarized the key ideas.

It was also observed that teachers in this study who allowed children to explore objects and materials came to class with realia and asked children to examine, describe, compare, sort, classify, draw and paint the specimens in their exercise books. Such teachers’ drew children’s attention to relevant features of the specimens (“do you see the colour differences in these fruits?”); gave hints (“is this one rough or smooth?”). The children responded: “this one is green” (referring to an avocado fruit), “this one is red” (referring to a ripe tomato and the other one is orange (referring to a ripe orange). All the children said that the tomato had a smooth surface while the avocado and orange had slightly rough surface.
The findings further show that teachers in the study did not engage children in doing simple investigations, using simple tools to extend observations and encouraging them to hypothesize. Teachers were not observed to guide children in sharing and discussing ideas.

The researcher noted a difference in the use of inquiry based instructional approach among the trained and untrained teachers. Apart from allowing children to explore objects and materials, teachers also used questioning, recording and listening strategies. All the two untrained teachers did not provide children with opportunity to use simple tools to gather knowledge, do experiments, hypothesize, discuss ideas or even in learn activities aimed at helping children to describe, compare, sort, order and classify learning materials. This could probably be due to lack of training. All the teachers did not engage children in some of the inquiry based instructional strategies such as doing simple experiments, manipulation of simple tools and hypothesize. This study found that pre-primary science teachers in the study area were using IBI approaches in their lessons.

4.4 Level of training and teachers use of inquiry based instructional

The second objective aimed at establishing the how teachers’ level of training influenced use of inquiry based instructional approaches in pre-primary schools. The researcher examined the frequency of teachers’ use of inquiry based instruction per training level and the results are shown in Table 4.3. The frequency of use was measured on a 5-point Likert scale of:
1 - Never not applied at all
2 - Almost never applied 1-2 times
3 – Occasionally applied 3-4 times
4 - Almost every time applied 4-5 times
5 - Every time applied more than 5 times

Table 4.3: Use of IBI in relation to teachers’ level of training

<table>
<thead>
<tr>
<th>Level of training</th>
<th>Frequency of engaging children in:</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Exploring</td>
<td>Questioning</td>
<td>Experimenting</td>
</tr>
<tr>
<td>P1 trained</td>
<td>3</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>ECDE certificate trained</td>
<td>4</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>ECDE diploma trained</td>
<td>4</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>ECDE degree trained</td>
<td>4</td>
<td>5</td>
<td>1</td>
</tr>
</tbody>
</table>

The results show that P1 trained teachers almost never applied inquiry based instructional approaches (used 1-2 times), ECDE certificate and diploma trained teachers occasionally used IBI (applied 3-4 times), while ECDE degree trained used IBI almost every time (applied 4-5 times). This meant that ECDE graduate teachers used IBI more than other teachers in the study sample. Atieno (2013) investigated influence of teacher’s characteristics on effective use of inquiry based approach in
teaching science in preschools in Kuja Zone, Rongo District, and established that teachers’ level of training did not significantly influence the teaching of science using inquiry.

4.5 Type of training institution and use of inquiry based instructional approaches

The third objective aimed at determining how type of training institution influenced teachers’ use of inquiry based instructional approaches in teaching science in pre-primary schools. The frequency of use per type of training institution was measured on a 5-point Likert scale of:

1 - Never          not applied at all
2 - Almost never   applied 1-2 times
3 – Occasionally   applied 3-4 times
4 - Almost every time  applied 4-5 times
5 - Every time     applied more than 5 times

Table 4.4: Use of IBI in relation to type of training institution

| Descriptors of Inquiry-based Instruction | Type of training institution and teachers frequency of engaging children in IBI: |
|----------------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
| Exploring objects and materials         | Primary teacher training college | Private ECDE training college  | DICECE training centre          | University                      |
| Using tools to do investigations        | 1                               | 1                               | 1                               | 1                               |
| Asking questions                        | 5                               | 5                               | 5                               | 5                               |
| Doing simple experiments                | 1                               | 1                               | 1                               | 1                               |
| Recording observations                  | 2                               | 3                               | 3                               | 4                               |
| Describing, comparing, sorting,        | 2                               | 4                               | 3                               | 4                               |
| classifying and ordering                |                                 |                                 |                                 |                                 |
| Identify patterns and relationships     | 2                               | 4                               | 4                               | 5                               |
| Hypothesizing                           | 1                               | 1                               | 1                               | 1                               |
| Sharing ideas                           | 1                               | 1                               | 1                               | 1                               |
| Listening to explanations               | 5                               | 5                               | 5                               | 5                               |

| Mean                                     | 2.30                            | 2.90                            | 2.80                            | 3.10                            |
| SD                                       | 1.57                            | 1.73                            | 1.69                            | 1.85                            |
The results shown in Table 4.5 indicate that all the teachers used the questioning technique and verbally explained concepts to listening children more frequently. None of the teachers however provided children with a variety of simple tools to do investigations or experiments, encouraged hypothesizing and sharing of ideas among children. The results indicate that all the surveyed teachers used some inquiry based instruction and did not use others. These findings therefore seem to suggest that the type of training institution does not influence the teacher’s practice towards the approach. These results do not match the findings of Rotumoi and Too (2012) who found that the institution one had trained from had a great influence on the approaches he or she adopted in teaching. A study by Bramald, Hardman and Leat (1995) did not establish a positive link between the type of training institution and use of IBI approaches. The mixed findings of Rotumoi, et al (2012) and Bramald, et al. (1995) provided a research gap that this study sought to fill.

When the teachers were interviewed to indicate the inquiry based instructional strategies that they perceived to have used during the science lessons observed, each of the four teachers that received training in primary teacher training college commented:

Teacher 1: *I asked children questions, posed scenarios that encouraged children to think and share ideas*

Teacher 2: *Children asked their inquisitive questions.*

Teacher 3: *Children had the opportunity to manipulate objects*

Teacher 4: *I am not sure of the strategies I used. I am not well conversant with IBIs*
Analysis of observational data showed that half (50%) of the teachers used questioning strategy while a quarter (25%) allowed children to manipulate objects. The results indicate that apart from questioning and allowing children to explore objects and materials, none of the P1 trained teachers appear to mention having encouraged children to share and discuss ideas. Except for the teacher that was not sure of the IBI strategies used, the rest seem to suggest a mismatch between what the other teachers said and what they practiced.

The responses from the five teachers from private ECDE colleges were:

Teacher 5: *I allowed engaged children in drawing and colouring, listening and singing as they worked.*

Teacher 6: *I made sure I gave children a science story and asked questions related to the story. Gave them crayons to colour pictures and engaged them in thinking around.*

Teacher 7: *I gave children opportunity to handle materials I brought in class. In one instance I posed questions that lead to making predictions like “what do you think will happen if…?”*

Teacher 8: *I often took children to a walk around the school compound to explore nature, collect and sort out specimen collected among others.*

Teacher 9: *Mmmm! In one of the lessons, I brought some water in class and asked children to experiment to find out which materials dissolved and which did not. In other lessons provoked children’s thinking through asking questions.*

Although teachers indicated they used a variety of inquiry based instructional approaches, observation results showed that 40% of the teachers did engage children in drawing while another 40% had children exploring objects and materials during the science lessons observed. The rest 20% could not remember or reflect very well on what happened during the lessons. None of them did simple experiments with the
children as reported by teacher nine. This therefore rules out use of experiments even though a teacher from private ECDE College reported using the strategy.

The majority of the responses were obtained from the DICECE trained teachers who had this to say:

Teacher 10: “I think I was able to encourage children to ask questions and learn by doing, reciting and singing.”

Teacher 11: “I gave children opportunity to generate hypotheses.”

Teacher 12: “My children had the opportunity to manipulate materials and equipment under my instruction and supervision.”

Teacher 13: “Encouraged children to share materials, observe, draw, colour and verbally ask their inquisitive questions.”

Teacher 14: “I think I encouraged children to discuss and interpret observations.”

Teacher 15: “I am not sure which aspect of inquiry I may have used but I remember to let children observe plants and animal features, draw pictures and recite poems related with the subtheme.”

The results show that some teachers reported having encouraged children to discuss and interpret observations and generate hypothesis. However, data from observation indicated that most of these teachers never employed these two inquiry based instructional approaches as reported. Thirty three percent used questioning technique, another 33% involved children in drawing and 17% had children manipulating objects. The remaining 17% could not recall very well what inquiry approaches they engaged in the lessons taught. There appears to be inconsistency in the reported and observed results. There seems to be a relationship in the strategy of inquiry used by teachers trained in private ECDE and DICECE training centres.
The only graduate teacher coded as Teacher 16 stated that:

“...oh yeah! In almost all the lessons I think I engaged children in asking scientifically oriented questions, availed resources necessary for inquiry, had children carry out activities by using materials, observing, evaluating, and recording information. They sorted out information and decided what is important. They observed details, detected sequences differences and similarities and I also engaged children in discussions stemming from experimental results.”

Observation results seem to concur with this respondent’s reflection as it was established that the teacher provided children with opportunity to explore objects and materials, asked and allowed children to ask questions. The teacher had children recording observations using words and drawings, allowed children to describe, compare, sort, classify, order and helped them to identify patterns and relationships. However, actual classroom observation revealed that this teacher never taught using experiments as indicated in the verbatim quote… “I also engaged children in discussions stemming from experimental results”.

The findings show that there was an element of inconsistency in what was reported and practiced by the teachers. Consequently, it was not logically possible to conclude that teachers from different training institutions engaged in the inquiry based instructional approaches that they mentioned. However, all the teachers employed some strategies of inquiry and avoided other critical ones.

When the teachers were asked to mention factors they perceived to influence their use of inquiry based instructional approaches in teaching science in ECDE; the following responses were obtained from the teachers who had been trained in primary teacher colleges:

Teacher 1: “I think the way tutors taught us in college influences the way I use inquiry in my teaching.”
Teacher 2: “The way I was taught in college.”

Teacher 3: “...In my view, the teaching methods learnt during training influences to some extent the way I teach using inquiry.”

Teacher 4: “…it is out of my own initiative that I have come to read about inquiry and find it useful. Thus, I am able to use the approach to some extent.”

The responses obtained from the five teachers that received training from private ECDE colleges regarding the question were:

Teacher 5: “…exposure to a given method. For example a person that has been exposed to inquiry may probably employ the approach in teaching”.

Teacher 6: “…self-confidence is what drives me towards teaching using inquiry since. Self-confidence is important because without it is unlikely to use this approach”.

Teacher 7: “…I had learnt a bit of inquiry during training in college”. That is what motivates me to use some aspects of the approach.

Teacher 8: “I am usually motivated to use inquiry by the information I get from the internet regarding the usefulness of the approach. I source a lot from the internet. This has been my inspiration.”

Teacher 9: “I must say that the content covered during training at college about heuristic learning influenced the way I teach science using inquiry.”

Excerpts from teachers that were trained in DICECEs regarding the same issue were:

Teacher 10 …The teaching methods I learnt while in college.

Teacher 11: the financial support I receive from the school management. For example, the manager buys learning materials for the children and emphasizes learning by doing.”

Teacher 12: “I teach according to instructions given by the manager.”

Teacher 13: “My exposure to inquiry and science experiences in high school and college.”

Teacher 14: “I think I am encouraged to use inquiry as a result of the little inquiry content covered in college.”

Teacher 15: “Parents. They look at the children’s book. They do not care about whether the teacher uses inquiry in teaching. They want to see if their children can read and write. That is why I do not lay a lot of emphasis in the use of inquiry.”
The one teacher with a bachelor degree from the University commented:

“...Well, at the University, I undertook several units in methodology of teaching. We engaged in several aspects of inquiry learning. I then developed interest in using inquiry.

The main factors perceived to influence teachers’ use of inquiry based instructional approaches were:

**Table 4.5: Factors influencing teachers use of IBI approaches**

<table>
<thead>
<tr>
<th>Factor</th>
<th>Number of teachers that mentioned the factor</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>i)  Teaching methods learnt during training</td>
<td>2</td>
<td>13.0</td>
</tr>
<tr>
<td>ii) Content learnt during training</td>
<td>3</td>
<td>18.0</td>
</tr>
<tr>
<td>iii) Exposure to inquiry</td>
<td>2</td>
<td>13.0</td>
</tr>
<tr>
<td>iv) Self-motivation and confidence</td>
<td>2</td>
<td>13.0</td>
</tr>
<tr>
<td>v)  School policy</td>
<td>1</td>
<td>6.0</td>
</tr>
<tr>
<td>vi) Financial support from management</td>
<td>1</td>
<td>6.0</td>
</tr>
<tr>
<td>vii) The way one was taught in college</td>
<td>2</td>
<td>13.0</td>
</tr>
<tr>
<td>viii) Usefulness of the approach</td>
<td>1</td>
<td>6.0</td>
</tr>
<tr>
<td>ix)  Availability of reference source from the internet</td>
<td>1</td>
<td>6.0</td>
</tr>
<tr>
<td>x)  Parents aspirations</td>
<td>1</td>
<td>6.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>16</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

Overall results show that the teachers’ reported use of inquiry instructional strategies and methods was influenced by the following: content learnt during training, teaching methods learnt during training, exposure to inquiry and the way one was taught in college. Other factors that were established included one’s self-motivation and confidence, the way one was taught in college, school policy and financial support from the school management, perceived usefulness of the approach, availability of reference source from the internet and parents’ aspirations. The type
of training institution however appears not to have been mentioned by all the teachers. This concurs with the observation results that showed that teachers, irrespective of where they received training used some strategies of inquiry based instruction and avoided using others.

In an examination of factors influencing Kuwaiti science teachers’ use of inquiry-based instruction, Dalal (2013) found that teachers’ attitude towards using IBI significantly influenced their capacity to create and deliver lessons that were based on IBI. The results of the current study also support the findings of Forbes and Davis (2010) and Choi and Ramsey (2009) whose studies established that the critical contributing factors to teachers’ use of IBI are attitudes, age, qualification, teaching experience and number of teaching periods and grade level. Peled, Kali and Dori (2011) found that the level of support teachers get from the teachers influences use of IBI. The findings are also in line with other studies such as Abell and McDonald (2004); Newman et al., (2004); and Songer et al., (2002); that education level or degree earned, years of teaching experience, school characteristics influences teachers use of inquiry. Learning science through activities is an integral part of early childhood education. It is therefore important to address the factors influencing use of IBI negatively to enhance its use in pre-primary science classroom in Kenya.

4.6 Teaching experience and use of inquiry based instructional approaches

The fourth objective of the study aimed at examining how teaching experience influenced teachers use of inquiry based instructional approaches in teaching science in pre-primary schools. The frequency of use number of years of teaching experience was measured on a 5-point Likert scale of:
1 - Never used IBI not applied at all
2 – Almost never used IBI applied 1-2 times
3 – Occasionally used IBI applied 3-4 times
4 – Almost every time used IBI applied 4-5 times
5 – Frequently used IBI applied more than 5 times

Table 4.6: Use of IBI in relation to number of years of teaching experience

<table>
<thead>
<tr>
<th>Teaching experience</th>
<th>Frequency of engaging children in:</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Exploring objects</td>
<td>Questioning</td>
<td>Experiencing</td>
</tr>
<tr>
<td>Less than 2 years</td>
<td>2</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>2-5 years</td>
<td>2</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>6-10 years</td>
<td>3</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>11-15 years</td>
<td>2</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>More than 15 years</td>
<td>2</td>
<td>5</td>
<td>1</td>
</tr>
</tbody>
</table>

Teaching experience was hypothesized to be among the probable determinants of use of inquiry based instruction in teaching science in ECDE. To evaluate if this was really the case, the frequency of teachers by experience that used of inquiry based instructional approaches during the survey was established. The results show that irrespective of the number of years of teaching experience, teachers used certain IBI in the teaching of science in and avoided others. Thus, teaching experience does not seem to predict use of inquiry based instructional approaches.
Gode, Obegi and Macharia (2014) found that the length of service of teachers in teaching profession influences the use of certain teaching methods. The teachers with 1-5 years of experience in teaching have substantive readiness to adopt and use new pedagogy in teaching unlike teachers with more years of experience but without interests and skills in technology. Crawford (2007); Bianchini and Cavazos (2007); Kurga (2014) found a positive relationship between teacher experience and use of teaching methods. Teacher experience can either have or lack notable impact on an individual’s teaching ability depending on what s/he encountered or acquired earlier on and how it applies to the new form of learning (Ndegwa, 2005; Ng’asike, 2004). This argument is also reaffirmed by Haefner (2004), who maintains that a teacher is considered as efficient and knowledgeable if he or she has more than three years of experience. Leonard, Moore and Spearman (2007) also add that a teacher with little experience but have undergone lengthy and extensive training in teacher education is more efficient in the classroom compared to that have wealthy of experience with little education. According to Chemwei, Njagi and Koech (2014), the experience of teachers has a considerable influence on adoption and use of pedagogy in daily classroom activities. These empirical studies provide the notion that the more experienced the teachers are, the more they readily adopt new curriculum methodologies in the teaching and learning processes.
CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

In this chapter the researcher has presented a summary of the key findings, conclusions and recommendations arising from these findings for possible action and further research.

5.2 Summary of the key findings

The purpose of this study was to establish the determinants of use of inquiry based instruction by early childhood teachers’ in teaching science in Meru South Sub-County and to identify factors related to the use of inquiry.

5.1.1 Teachers’ use of inquiry approach

The findings of this study revealed that teachers applied various strategies of inquiry approach when teaching. These strategies included engaging the learners in the process of learning by asking questions, probing for more explanations on the topic of study, as well as using the students’ responses to gauge their level of understanding and attitude towards the topic. The analysis of the teaching sessions also showed that the young learners acquired various skills at different stages of inquiry. Such skills comprised on drawing, classifying, listening, sorting, ordering, and describing. Although lesson observations indicated that indeed teachers were engaging the young learners in the learning process, there was limited evidence to point to the fact that discussion, exploration, experimentation and hypothesizing were encouraged in the classrooms. The indicators of inquiry approach in teaching is where a teacher encourages the learners to explore what is being taught and hence
arrive at their own conclusions before the teacher provides the additional
instructions to help them grasp the concepts more easily.

Exploration is also promoted when teachers decide to create opportunities that
courage the learners to collaborate as they tackle the tasks and assignments given
to them. Based on the observations, the researcher found out that most of the teacher
sessions did not in any way promote exploration. Although the teachers maintained
their claims that their teaching approaches employed a number of inquiry-based
instructional strategies, the observations revealed that that was not actually the case.
The young learners in the classrooms remained predominantly passive, uninterested,
and static throughout the entire lessons. They remained seated on their desks without
significant interactions amongst themselves and the teachers. No pairing of group
work was observed during the lessons. The teachers only appeared to be transferring
knowledge to the young learners by talking and writing on the chalkboard.

It was largely noted that the teachers’ only focused on the content transfer and did
not give the children an opportunity to apply what they have learnt or harness the
skills adequately through interactions in the classroom. For example, all the teachers
did not engage children in some of the inquiry based instructional strategies such as
doing simple experiments, manipulation of simple tools, sharing and discussing
ideas and hypothesizing.

5.1.2 Level of training and teachers use of inquiry-based instructional approach

A central focus of this study was to establish the extent to which teachers’ level of
training influenced their use of inquiry-based instruction in science teaching in pre-
primary schools. The findings from this study indicate that 89% of the teachers that
participated in the survey were trained while the rest were untrained. Majority 33% of the teachers were had ECDE certificate level of training.

The results of this study show that regardless of the level of training, all the surveyed teachers allowed children to explore objects and materials, asked and allowed children to ask questions during science lessons, involved children in recording observations using words and drawings. A similar trend was established in relation to teachers helping children to identify patterns and relationships among events. Teachers of all levels of training appeared to verbally explain scientific concepts to the children as they listened. All the teachers did not provide children with the opportunity to use simple tools to do simple investigations; hypothesize and have discussions to reflect and share ideas.

There were similarities in the use of six inquiry based instructional strategies namely: questioning, object manipulation, recording of observations, helping children acquire science process skills, establishing relationships and giving explanations to clarify concepts. Teachers’ did not children in doing simple experiments, hypothesizing and discussing ideas. The findings seemed to suggest that teachers’ level of training had no influence on the teachers’ use of experiments, helping children to hypothesize and discuss science matter.

5.1.2 Type of training institution and teachers’ use of inquiry-based Instructional Approaches

Results obtained in this study show that irrespective of the type of training institution the teachers used the following inquiry-based instructional strategies: questioning, drawing, listening, writing, classifying, and ordering, sorting, describing and limited exploration. However, all the teachers did not use
exploration, discussion, experimentation and hypothesizing inquiry strategies in the classrooms.

5.1.3 Teaching experience and use of inquiry-based instructional approaches

In this study teacher experience in teaching science was hypothesized to be among the probable determinants of teachers’ use of inquiry based instruction in teaching science in pre-primary schools. The results of this study reveal that irrespective of the number of years of teaching experience, all teachers used certain aspects of inquiry and avoided others.

5.3 Conclusions

From the findings obtained in this study it can be concluded that pre-primary science teachers were using some inquiry-based instruction in their science classrooms. Another important deduction that can be made from the findings of this study is that teachers’ level of training, teaching experience and type of training institution does not significantly bring about differences in the use of inquiry based instructional approaches as a similar trend was established in use of some inquiry-based instruction and non-use of others irrespective of teachers gender, level of training, type of training institution and teachers years of experience.

In order to have a perfect implementation of the inquiry-based instruction in the elementary classroom, there teachers must change their traditional way of teaching science and embrace more of participative learning where children are directly involved in the generation of scientific ideas and knowledge. Although this may prove to be a complex and time-consuming approach, it is a mode of learning that children in elementary schools need for them to be part of the scientific community. Therefore, it is important for the teachers to acquire the skills of promoting
interactive learning while they are still in training for them to easily disseminate the same to the children through inquiry-based instruction.

5.4 Recommendations of the study

The following recommendations were made:

i) Teachers need to be trained and encouraged to use inquiry-based instruction in order to effectively teach science at pre-primary level. The Kenya Institute of Curriculum Development should re-design ECDE teacher training curriculum emphasizing on use of inquiry-based teaching and learning of science. Head teachers and managers of early childhood centres provide teachers with adequate instructional resources to enable them engage learners in inquiry learning.

ii) In order to enhance teachers’ level of training in the use of inquiry-based instruction in teaching science in pre-primary schools, induction programmes and continuous professional development of teachers is recommended. Thus, training teachers, especially through modeling of inquiry instruction is crucial for effective implementation of inquiry based-learning for the improvement of learning as well as the pedagogy of the teachers.

iii) Teacher training institution in Kenya should ensure quality teaching and learning are centred on the development and upgrading of educational staff competences in the use of inquiry based instructional approaches in teaching science in pre-primary schools.

iv) Schools should not recruit science teachers basing on number of years of teaching experience but on considerations of teacher effectiveness in instructional pedagogy.
v) The Government should allocate sufficient resources to support the practice of inquiry-based learning in pre-primary schools. This can be done through building of laboratories and equipping them to promote inquiry learning right from this level.

5.4.1 Policy Recommendations

The inquiry-based teaching is an approach that heavily relies on the scientific inquiry thereby making it to be one of the constructivism teaching practices. It is an approach that is learner-oriented instead of the traditional teacher-oriented practices thus providing the learners with the opportunities and encouragement to participate in the learning process through active experimentation, use of questions and individual investigation of the scientific concepts. Many studies have proven the fact that inquiry-based instruction is capable of igniting the learning spirit in pre-school children because of its ability to create interest and enthusiasm in the acquisition of the scientific skills and knowledge. This research found that despite the benefits of using inquiry-based instruction approach, it was not popular among pre-school teachers in Kenya. Thus, it is the responsibility of the policy makers and curriculum developers to ensure that early childhood education is taken seriously through effective training of the teachers so that they develop pedagogical skills in specific science subjects. There is no doubt that the teacher qualifications required to take up an early childhood training programme should be raised in order to improve the quality of teachers being released to the market. The assumption that early childhood education does not require highly-skilled teachers does not hold in the modern days of rapid technological advancements were learners are expected to adapt to the changes in knowledge and skills as quickly as possible.
Basing on the findings of this study, the Ministry of Education has a role to play in ensuring that it formulates policies that are geared towards improving the teaching of science subjects in pre-primary schools. This would greatly discourage the usual ‘learning by rote’ approach that seem to have flourished in most elementary classrooms and usher in an inquiry-based style of learning that encourages younger learners to take charge of their own generation of scientific knowledge and ideas.

5.4.2 Recommendations for further research

The researcher has established gaps that need further consideration in research:

i) The current study explored early childhood teachers’ use of inquiry-based instruction in teaching science in early childhood classrooms in Meru South Sub County, Kenya. The study also determined factors that impact use of inquiry based instructional approaches. There is a need to identify the beliefs brought by in-service or pre-service science teachers to their teacher education programme about teaching using inquiry.

ii) As noted in the literature review, previous researches have provided conclusive evidence that inquiry-based instruction approaches are more advantageous in helping students acquire scientific knowledge and skills compared to the traditional knowledge transfer methods. However, the majority of these studies utilized secondary data in arriving at the findings. Some relied on the laboratory experiments that in actual sense do not reflect the actual experience in the classrooms. This research is different in the sense that it derived much of the data from the actual experience in the typical classrooms in several pre-primary schools in Kenya. Unfortunately, the study was largely qualitative in nature and therefore some of the information that required quantification and measurements
was not captured. For that reason, future research on the similar topic should incorporate both the qualitative and quantitative research methods in order to make conclusive and reliable deductions.
REFERENCES


Ng’asike, J. T. (2010). *Turkana Children’s Socio-Cultural Practices of Pastoralist Lifestyles and Science Curriculum and Instruction in Kenyan Early*


APPENDICES

APPENDIX A: INTRODUCTORY LETTER

Presbyterian Teachers Training College Rubate
P.O BOX 177-60400
Chuka.

THE HEAD TEACHER

…………………………...

Dear Sir/Madam,

REQUEST FOR PERMISSION TO CONDUCT A RESEARCH

I am a student enrolled with the Kenyatta University and presently conducting a study whose purpose is to establish Determinants of Use of Inquiry Based Instruction in teaching science by teachers in Early Childhood Education in Meru South Sub-County, Kenya, as part of the requirement for the award of a degree in master of education in Early Childhood Studies.

The researcher promises confidentiality on the information that will be provided by the respondents.

Thanking you in anticipation for a positive response.

Yours Faithfully

Joachim Njagi
Researcher
Dear Participant,

Request for Consent to Participate in Research Project

I am Joachim Njagi a master’s student in the Department of Early Childhood Studies in the School of Education at Kenyatta University. I am conducting research on the Determinants of Use of Inquiry Based Instruction in teaching science by teachers in Early Childhood Education in Meru South Sub-County, Kenya, and would value your participation as you would be an asset to this study.

If you consent, I will humbly request to you to be available for the interview. Please note that your confidentiality and privacy will be strictly adhered to and protected. In your own preference, you may just provide a pseudonym instead of your real name. In addition, participating in this study is entirely voluntary and you may withdraw at any point depending on your own institution without any consequence.

Kindly sign this form when you are willing to participate in this study.

I understand that my participation is voluntary and that I may withdraw at any time.

I (name)………………………………………………………………consent to participate voluntarily in the above research project.

Signed……………………………………. Date………………………
APPENDIX C

OBSERVATION GUIDE

Section A: General information

Name of teacher

School

Title of lesson

Date

Time

Section B: Observation Checklist

Researcher will note (tally) the frequency a certain feature of inquiry is used.

Frequency of occurrence of inquiry teaching practices

<table>
<thead>
<tr>
<th>Frequency of teachers practice in .....</th>
<th>Frequently</th>
<th>Sometimes</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provoking children to think</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Encouraging children to ask questions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Encouraging children to generate hypotheses</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Encouraging children to manipulation materials, equipment and active learning tools to gather information</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Encouraging children to verbally interpret outcomes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Encouraging children to discuss interpretations in small groups</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Involving children in use of data to construct a reasonable explanation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Encouraging children to verbally communicate findings from investigations</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX D

INTERVIEW GUIDE FOR TEACHERS

Section A: Teacher details (qualification and experience)

1. Are you a trained teacher? a) Yes ( ) b) No ( ) if yes…..

   Where did you train as a teacher?

   Private ECD College ( )
   Public ECD College ( )
   Teacher training college ( )
   Public/private university ( )

2. What is your level of academic or professional qualification?

<table>
<thead>
<tr>
<th>Qualification</th>
<th>Researcher to Tick</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECDE degree</td>
<td></td>
</tr>
<tr>
<td>ECDE diploma</td>
<td></td>
</tr>
<tr>
<td>ECDE certificate</td>
<td></td>
</tr>
<tr>
<td>P1 certificate</td>
<td></td>
</tr>
<tr>
<td>Untrained</td>
<td></td>
</tr>
</tbody>
</table>

3. What mode of study did you undergo?

   a) Full-time……..b) in-service

4. What was the duration of training?

5. Do you think the content learnt during training was sufficient to enable you to
teach science using inquiry? Please elaborate.

6. What is your teaching experience?

7. How long have you been teaching class science at pre-primary level?
8. Do you think your teaching experience influences your attitudes toward using inquiry instruction? Explain.

**Section B: Inquiry based learning**

Here are some of the inquiry based learning approaches. Could you describe how often you used each in teaching? The researcher captured the responses elicited by ticking in the correct box.

<table>
<thead>
<tr>
<th></th>
<th>Never or hardly ever</th>
<th>In some lessons</th>
<th>In most lessons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provoked children to think</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Encouraged children to ask questions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gave children opportunity to generate hypotheses</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gave children opportunity to manipulate materials and equipment to gather information following my instruction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Encouraged children to verbally interpret outcomes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Encouraged children to discuss interpretations in small groups</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Involved children in use of data to construct a reasonable explanation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Encourage children to verbally communicate findings from investigations they have conducted</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Kindly would you describe what motivates your choice of teaching approaches?

2. What would you consider to be the main reason why you use or don’t often use inquiry-based instructional methods?
APPENDIX E

SAMPLE OF AUDIO TAPED TRANSCRIPTIONS

General Instructions

1) The transcriber transcribed all individual taped interviews.

2) Questions or comments made by the interviewer were labeled I: on the left margin of the interview sheet while the responses of respondents were labeled P: immediately below the I:

3) Transcription of the audiotapes was done verbatim, that is, recorded word for word or exactly as said.

4) All nonverbal sounds such as coughs, chuckles, signs, and laughers were also recorded. Such sounds were represented by parentheses, for example, (coughs…)

5) Mispronunciation of the words was captured as it is during transcription and left the way they were without corrections.

6) Square brackets were used to represent words that the interviewer did not comprehend. The square brackets were then enclosed in forward and backward slashes.

7) The transcripts also indicated when the interview was completed.

Example of a taped interview transcription

I: OK, before we begin the interview, would you kindly confirm to me that you have read and understand the what this study is all about and that you participation is entirely voluntary. We take your confidentiality as our first priority and can only
proceed to interview you if you have willingly signed the informed consent form. Feel free to decline answering certain questions that you may find uncomfortable. You may also withdraw from the study anytime you feel like. With your permission do you feel we should proceed?

P: Yes we can.

P: I also understand what you have highlighted, thank you.

I: Do you have questions, comment, suggestion, or observation to make before we proceed?

I: I would like you to tell me about your background as an early childhood teacher. What is your teaching experience?

P: I have been teaching for close to 4 to 5 years now

I: Where did you train as a teacher?

P: I trained in a private ECDE college

I: What is your qualification?

P: Diploma

I: To what level have you studied science?

P: Diploma level

I: Have you studied early childhood science and to what level? What was the duration of training?

P: Yes. Up to diploma level where I studied science activities for one semester

I: What subjects do you currently teach?

P: I teach all ECDE activity areas that encompass number work, language, outdoor, science, social environmental, life skills, religious education, music and movement and creative activities.

I: What subjects do you prefer to teach?
P: I enjoy teaching outdoor and social environmental activities.

I: Now, I’d like to know about your awareness and understanding of inquiry instruction in early childhood science teaching. What does inquiry learning mean to you?

P: I am not sure i know the meaning, but i think it is related to getting to the bottom of something.

I: Do you think the high school and college science experiences have an influence on your ability to teach science at ECDE level using inquiry instruction?

P: Absolutely yes. While in high school I disliked chemistry and physics because most of the concepts taught seemed abstract to me though there was fun during some chemistry lessons. I feel a novice in handling science well due to this.

I: Based on the high school and college science experiences would you describe your overall interest in science as low or high?

P: Low.

I: It has been alleged that ECDE teachers don’t have enough science content knowledge. What is your opinion?

P: To some extent it’s true because personally feel I don’t have sufficient knowledge about science.

I: Now I’d like you to talk about your views on teaching early childhood science using inquiry learning approaches. How much time do you spend weekly teaching science?
I seldom have time to prepare as I handle all subjects and also attend to other children cues.

How much time do you spend weekly preparing to teach science (include planning and material gathering)?

As I said earlier, there isn’t time to prepare. Therefore I can’t quantify this.

Which teaching methods do you commonly use in your science lessons? Why?

I mostly use directed teaching and occasionally engage children in singing and storytelling and reciting poems. I prefer direct teaching because it gives me opportunity to explain and clarify concepts that are unfamiliar to children.

How would you define inquiry science teaching?

I am not sure i know the meaning, but i think it is related to getting to the bottom of something.

Do you teach using the inquiry method?

Not really.

In your opinion, why have you not used inquiry instruction more frequently in science classrooms?

Because a lot of time is required to conceive and design the activities and each activity area is allocated only 30 minutes which is inadequate to incorporate inquiry.

What skills do you think would be needed to facilitate science as inquiry?

Knowledge of how to translate children inquisitive questions into experiments and activities.
I: At this juncture I’d like you to talk about what helps you do the things you want to do in order to support children’s scientific investigation and on the other hand discuss the barriers to effective science teaching using inquiry method. What according to you influences the way you teach early childhood science?

P: I think the training I received greatly influences the instructional methods I use in class.

I: In your opinion what factors promote or hinder teachers’ use of inquiry?

P: In my view I think the subject area taught, the developmental ability of the learners and the extent of a teacher’s pedagogical and content knowledge may dictate whether one uses inquiry or not.

I: We have come to the end of the interview session. But just before we call it a day, is there anything else that you would like to suggest, comment, or add?

P: No. That’s all I had to say.

I: Well, thanks for finding time for this interview. I appreciate it.

END OF INTERVIEW
APPENDIX F

MAP OF MERU SOUTH SUB-COUNTY

Source: Central Bureau of Statistics
NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

Telephone: +254-20-2213471, 2241349, 310571, 2219429
Fax: +254-20-318245, 318249
Email: secretary@nacost.go.ke
Website: www.nacost.go.ke
When replying please quote Ref: No.

Date: 25th September, 2014

NACOSTI/P/14/3044/3087

Joachim Njagi Kirea
Kenyatta University
P.O. Box 43844-00100
NAIROBI.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on "Teachers use of inquiry based instruction in teaching science in Early Childhood Education in Meru South District, Tharaka-Nithi County, Kenya," I am pleased to inform you that you have been authorized to undertake research in Tharaka Nithi County for a period ending 31st December, 2014.

You are advised to report to the County Commissioner and the County Director of Education, Tharaka-Nithi County before embarking on the research project.

On completion of the research, you are expected to submit two hard copies and one soft copy in pdf of the research report/thesis to our office.

DR. S. K. LAMBAT, OGW
FOR: SECRETARY/CEO

Copy to:

The County Commissioner
The County Director of Education
Tharaka-Nithi County.
APPENDIX H

RESEARCH PERMIT

THIS IS TO CERTIFY THAT:

MR. JOACHIM NJAGI KIREU

of KENYATTA UNIVERSITY, 0-04000

Chuka, has been permitted to conduct research in Tharaka-Nithi County on the topic: TEACHERS USE OF INQUIRY BASED INSTRUCTION IN TEACHING SCIENCE IN EARLY CHILDHOOD EDUCATION IN MURU SOUTH DISTRICT, THARAKA NITHI COUNTY, KENYA for the period ending 31st December, 2014.

Permit No.: NACOSTI/P/14/3044/3087
Date Of Issue: 25th September, 2014
Fee Received: Ksh. 1000

To: National Commission for Science, Technology & Innovation

Applicant's Signature

Mr. JOACHIM NJAGI KIREU

To: National Commission for Science, Technology & Innovation

Secretary

National Commission for Science, Technology & Innovation