TEACHER FACTORS INFLUENCING USE OF MUSIC AS A MEDIUM OF TEACHING MATHEMATICS IN PRE PRIMARY SCHOOLS IN NAIROBI CITY COUNTY, KENYA

BY

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DECLARATION

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

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This study is dedicated to Almighty God, my loving parents Peter Macharia and Alice Macharia, my twin brother John Kihiu Macharia, my husband Alex Macharia and my beautiful daughter Sifa.

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ABBREVIATIONS ANDACRONYMS

DICECE	District Centre for Childhood Education
EACE	East Africa Certificate of Education
ECDE	Early Childhood Education and Development
KACE	Kenya Advanced Certificate of Education
KCE	Kenya Certificate of Education
KCPE	Kenya Certificate of Primary Education
KCSE	Kenya Certificate of Secondary Education
KIE	Kenya Institute of Education
NACECE	National Centre for Early Child Education
NAEYC	National Association for the Education of Young Children
NAMC	National Association for Music Education
NCC	Nairobi County Council
NCTM	National Council of Teachers of Mathematics

ABSTRACT

Music is a significant teaching strategy in early childhood education it improves development of young children's self-confidence, self-esteem and their expression orally and mentally. Despite the fact that, use of music is a strategy that motivates and sustains children's interest in the learning of mathematics, research studies in this area are scanty. The purpose of this study therefore was to find out preschool teacher factors influencing the use of music as a mode of teaching mathematics within Kasarani, Nairobi County. The study sought to determine the link between preschool teacher factors namely their training, teaching experience, academic qualifications, and attitude towards use of music in teaching mathematics.Theory of planned behavior by Ajzen and Fishbein (2010) guided the descriptive survey research design study. The study's dependent variable was use of music as a medium of teaching mathematics while the independent variables were preschool teacher factors influencing use of music in teaching mathematics. Multistage sampling technique was used to arrive at the required sample size. Specifically, random sampling was used to select 15 preschools out of the 30 targeted and purposive sampling used to select 15 head teachers out of 30 and 45 out of 90 preschool teachers. An observation guide and questionnaires were used to collect data for preschool teachers and head teachers. A pilot study was conducted in four public preschools using their head teachers and eight teachers. To ensure validity of the instruments, the study content was strictly guided by the objectives while the split half technique was used to ascertain reliability of the instruments at a coefficient of 0.7. Quantitative data were analysed using the thematic approach and presented in narrative form while for quantitative data, descriptive statistics involving frequencies, standard deviation, means and percentages were employed. Inferential statistics used to test null hypothesis Chi-Square at alpha value 0.05 ($p<0.05$). The inferential statistics established significant association between teacher training and teacher attitude and use of music during mathematic instructions. However, the study did not find significant relationship between teacher academic qualifications and experience and use of music during mathematic instructions. The study concluded that preschool teachers in Kasarani Sub-County were using music to teach mathematics. The study recommended the Kenya institute of curriculum development should come up with modules on step by step guidelines on how to teachers should integrate music during maths lessons. The study also recommended that further research should be conducted to establish other factors that may influence use of music to teach mathematics.

CHAPTER ONE

INTRODUCTION AND CONTEXTUALIZATION OF THE STUDY

1.0 Introduction

This chapter presents the background to the study, the statement of the problem, purpose of the study, objectives and hypotheses. Additionally, significance of the study, limitations and delimitations, assumptions, theoretical and conceptual framework and operational definitions were presented in the chapter**.**

1.1Background to the Study

Early Childhood extends from the end of infancy to about nine years of age; and can also be called the pre-primary school years. The use of Music in early years' foundation stage sets out the basis of pupils' experiences to learn. They get opportunities to play musical instruments, perform, sing and listen to music. Various studies in the western world have indicated that music improves intellectual abilities in early childhood (Bolduc, 2009). A report statement from the early childhood music education in the United States on music for young children recorded that children's communication is greatly influenced by music, as it improves their intellectual skills such as memory, reasoning, logic and arithmetic. Significant life skills including cooperation, collaboration and group work have been created through music, which also improves rudiments of an aesthetic sense and contributes to school readiness (Holland, 2011). In addition, Hanshumaker (1980) notes that Music develops language acquisition, reading readiness and cognitive development.

Mathematics is considered a core area of learning in most educational systems throughout the world. Mathematics creates opportunities for improving significant cognitive skills in communication, deductive and inductive reasoning, problem solving and creative thinking. Thus, in solving a problem one has to reason logically and systematically through deductive reasoning. Also, insights that lead to solutions require thinking creatively, divergently and imaginatively. Music is useful in enhancing children's motor skills. Sensory and motor functions in the brain are developed through use of music instruction. The use of songs strengthens sensory and motor function for children to do complex processes. Music also improves children's self-esteem. Hedrick (1998), observes that a child's ability to understand themselves as a competent individual is connected to self-esteem. He adds that children naturally develop as they learn and preschool children often feel competent when they engage in musical activities like dancing, drama, singing or moving in response to music. Notably, listening to music positively heightens children's moods and emotions causing them to feel happier. Music requires first hand meaningful participation that enhances excitement for children. Preschool teachers should organise musical activities in teaching mathematics to ensure meaningful participation of learners.

Kulm and Ma (2008); An, Ma and Capraro (2011)Benes-Laffety (1995); Omniewski (1999) and Burack (2005) state that musical elements like steady beat, rhythm, melody and tempo are related to math and music, thus posing inherent mathematical principles for example spatial properties and one correspondence. Mathematics brings enjoyment and pleasure as children begin to recognize numbers, patterns and shapes especially through the processes of classification and conceptualization.

Various studies by Aunola, Leskinem, Lerkkanen and Nurmi, (2004) have revealed that children's early mathematics performance is a strong predictor of their later mathematical achievements. For example, skills such as counting, number recognition, number comparisons, and non-verbal calculations, predict the rate of growth of mathematics achievement from first through third grade. Individual differences in early math abilities are also stable over childhood. Children who start off with better mathematical understanding often become more competent in math than their peers.

A study by Colwell (2000), found that American students who were not taught mathematics using musical instructions performed poorly in math tests as compared to their colleagues' who were taught using music. Lewis and Aiken (2000), adds that a student's personal attitude towards music and mathematics integration in the classroom environment and mathematics anxiety could be a factor that influences their achievement in the subject.

A joint statement by the National Association for the Education of Young Children (NAEYC) and the National Council of Teachers of Mathematics (NCTM) in 2002 highlighted teachers' central role in providing high-quality mathematics education to young children. The report suggested that teachers recognise the importance of establishing a good mathematical foundation in early childhood, acquisition of relevant knowledge and skills, and provision of substantial support. Clements and Sarama, (2007); Greenes, Ginsburg, and Balfanz, (2004), developed various research-based curricula aimed at improving early mathematics education. These curricula regarded musical experiences in ECD as 'fertile ground' where young children's

concepts could be clarified, extended and formed, and multi-sensory skills like impressions, motor manipulation, problem solving, creating and questions are developed. While music is widely appreciated as a great source of enjoyment in young children's lives, it has been regarded as a peripheral subject of interest whose addition to the curriculum was perhaps not very important.

Uwezo East Africa (2012), report on Music and arithmetic literacy cited that a third of pupils who were taught with adoption of music possessed basic numeracy skills. The above studies however did not establish the extent to which music as a factor affects pupils' achievement in Mathematics, hence the need for the study. According to Mutunga and Breakel (1992), basic mathematical skills should be well known by adults to assist children in career opportunities, choices, household budgets, community programs and daily life management, underscoring the need for further study on influence of children's mathematical interest through music beginning at the foundation level in early childhood. Mwangi (2000), reports that music instructional resources in teaching mathematics in primary school teachers' training colleges in Kenya were few and the available resources were underutilized or not used at all by the students and tutors. Hence, the current study explores the foundation of teachers' practices, their perspectives on early mathematics education and the barriers they perceive to including more math activities in class.

In Kenya, limited studies have been done in regards to use of music in mathematics achievement in preschool. Most studies done inquired on mathematics performance, which has generally been low. According to an assessment study report on monitoring

of learning achievement in numeracy for in Kenya, the mean score in class 3 stood at 295.6, which is slightly lower than the standardized mean of 300, and boys performed better than the girls. Eshiwani (1984), showed that poor teaching methods and acute shortage of textbooks contributed to poor performance in mathematics. Similarly, a task force report by Thika District Education board (2009), on causes of poor performance in KCPE Thika District outlined several reasons for poor performance. They included teachers' characteristics such as lack of dedication to class work, negative attitude and lack of team work. In addition, lack of some school facilities was mentioned as a reason for poor performance.

Most studies on music and learning in Kenya were based on secondary education and teacher training colleges. Conversely, limited studies had been conducted at pre-primary school level, specifically on preschool teacher factors affecting the use of music influence on preschool mathematics achievement in Kasarani, Nairobi County, Kenya.

1.2 Statement of the Problem

Music creates significant contexts for life skills for example cooperation, collaboration and group effort. In addition, it also develops rudiments of an aesthetic sense and contributes to school readiness. Music influences children's mathematical interest and achievement at the foundation level in early childhood. In spite of the importance of music as a medium of teaching Mathematics (Hanshumaker, 1980; Bolduc, 2009; Hedrick, 1998; Omniewski, 1999; Burack, 2005), the subject has not been accorded enough attention. Studies on factors purported to affect preschool teachers' use of

music in teaching mathematics were also limited in the Kenyan context. Moreover, local studies have focused on primary and secondary schools.

Use of Music in teaching Mathematics in preschool has not received much attention yet music plays a major role in laying a foundation for mathematics learning. This study sought to address this gap and investigated the use music as a medium of teaching mathematics in preschools in Kasarani Nairobi City County.

1.3 Purpose of the Study

The study investigated Teachers factors influencing use of music as a medium a medium of teaching Mathematics in pre-primary schools in Nairobi City County.

1.4 Objective of the Study

The study was structured and organized using the following specific objectives;

i. The study sought to establish the influence of preschool teachers' academic qualification on use of music in teaching mathematics.
ii. The study sought to determine the influence of teachers' level of training on use of music in teaching mathematics.
iii. The study sought to find out the influence of teachers' level of work experience on use of music in teaching mathematics.
iv. The study sought to determine relationship between teachers' attitude towards music on use of music in teaching mathematics.

1.5 Research Hypotheses

Section 1.5 presents the research hypotheses that were formulated during the study.

Ha1: There is a relationship between preschool teachers' academic qualification and their use of music in teaching mathematics.

Ha2: There is a relationship between preschool teachers' level of training and their use of music in teaching mathematics.

Ha3: There is a relationship between preschool teachers' level of teaching experience and their use of music in teaching mathematics.

Ha4: There is a relationship between preschool teacher's attitude towards music and their use of music in teaching mathematics.

1.6 Significance of the Study

This research study will provide information to head teachers on importance of the use of music as a medium of teaching mathematics and provide actions in schools. Secondly teachers may benefit by getting information on how to use music in teaching mathematics. Thirdly, ministry of education Science and Technology and County Government may use the findings to come up with interventions, ways of using music as a medium in teaching mathematics. Lastly, Kenya institute of curriculum development may use the findings to come up with modules on step by step guidelines on how teachers should integrate music during teaching mathematics concepts.

1.7 Limitations and Delimitation of the Study

Regardless of successful completion, the study experienced a number of limitations and operated with a few delimitations, which are discussed in this section.

1.7.1 Limitations of the Study

Most preprimary schools conduct their Mathematic lessons in the morning hours; therefore, lesson observations could only be done in the morning hours which greatly prolonged the data collection period. However, the researcher made appointment with some teachers to make up a Math class or conduct a Math lesson after 10am.

1.7.2 Delimitations of the Study

The study delimited itself to public preschools, head teachers and Pre Primary teachers sampled in Kasarani division, Nairobi County. Several factors such as pupils' attitude and classroom environment may influence integration of music in mathematics, but this study only concerned itself with teachers' factors that may influence use of music in teaching mathematics. They included teachers' academic qualification, teachers' training, teaching experience, teacher's attitude towards music and teachers' training in music.

1.8 Assumptions of the Study

The researcher made the assumption that pre-primary teachers' in Kasarani Sub-County used music in teaching mathematics concepts. It was also assumed that teacher's factors influenced the use of music in teaching mathematics. Another assumption was that use of music existed in preschools in Kasarani, Nairobi County. The researcher also made the supposition that all Public Preschools followed the curriculum developed by Kenya Institute of Curriculum Development (KICD), formerly known as Kenya Institute of Education (KIE) National Centre for Early Childhood Education (NACECE). Lastly, it was assumed that teaching in Preschool

allowed opportunity for optimum interaction of teachers and children through music learning.

1.9 Theoretical and Conceptual Framework

Section 1.9 discusses the theoretical and conceptual frame works upon which the study was based.

1.9.1 Theoretical Framework

The study was based on the theory of planned behavior developed by Ajzen and Fishbein (2010). Predicting and Changing Behaviour:

The theory recognizes the significance of assessing the extent of control an individual has over behaviors' and attitudes. It is anchored on the consideration that all behavior outcomes are not under deliberate control and that behaviors are positioned at some point along a scale that ranges from total control to complete absence of control. Control factors include both internal elements such as level of skills, abilities, information available and emotional susceptibility and external elements such as people, condition or environmental factors.

The theory therefore, predicts intentional behaviour because behaviour can be deliberative and planned. The control that an individual has over their own behaviour is determined by factors inside and also outside of them. The study focused mostly on investigating determinants outside the teachers (such as academic qualifications, training and experience). The teacher attitude constituted the internal factor. This study suggested that an individual decides how to behave depending on the

environment and other external factors. Ajzen further states that human behavior or action is guided by three kinds of considerations, that is, behavioral beliefs, normative beliefs and control beliefs.

Behavioural beliefs mean an individual considers the likely consequences of the behaviour. An individual's behaviour will be guided by the degree to which performance of the behaviour is positively or negatively valued. It is determined by the total set of accessible behavioural beliefs linking the behaviour to various outcomes. Normative belief means an individual's perception about a particular behaviour which is influenced by the judgment of significant others. This involves social influence based on whether the individual is expected by society to exhibit the recommended behaviour.

Lastly, control belief, this is the presence of factors that may facilitate or impede performance of the behaviour. The individual's behaviour will also be determined by their perceived ease or difficulty of performing the particular behaviour. The three considerations put together lead to the formation of behaviour intentions consequently lead to tangible behavior actions.

Application of Theory to the Study

In applying Ajzen's theory to the study, the researcher observed that teachers work in different school environments and structures where the expectations are different. The theory suggests that individuals plan how to behave; therefore, pre-primary teachers had different approaches towards use of music emanating from the nature of teaching

environments that they were in. On the consideration of behavioural beliefs, pre-primary teachers' use of music to teach mathematic is highly influenced by their knowledge of the benefits and ease of teaching mathematic concepts through use of music. Teachers who consider music as an effective teaching aid in mathematics instruction apply it more often than those who think music is not an effective teaching aid. Therefore, teachers' attitude towards use of music to teach mathematics is influenced by perceived level of performance.

With respect to normative beliefs, teachers' use of music to teach mathematics depends on the views, opinions and perceptions of significant individuals who have a direct influence on the teachers' behaviour. These may include other teachers, parents and community members around the school environment. Pre-primary teachers are likely to use music during mathematic instructions if these significant people are positive or advocate for its use and vice versa. Teachers' attitudes are also influenced by the evaluation and approval of significant others. In particular, the thoughts and opinions other people have about them. The social influence from the community within which a teacher works affects their attitude. The individual's attitude is shaped through the process of interacting with the community around them. On the consideration of control belief, teachers' use of music to teach mathematics can be facilitated or inhibited by their own belief about their capability to integrate music during instructions. Teacher capability may be related to academic qualifications, teacher training and experience. Teachers who perceive themselves capable of using music to teach mathematics are more successful than teachers who perceive

themselves incapable of doing so, that is, teacher positive or negative evaluation of self-performance.

1.9.2 Conceptual Framework

The conceptual diagram shows the relationship between the dependent and independent variables.

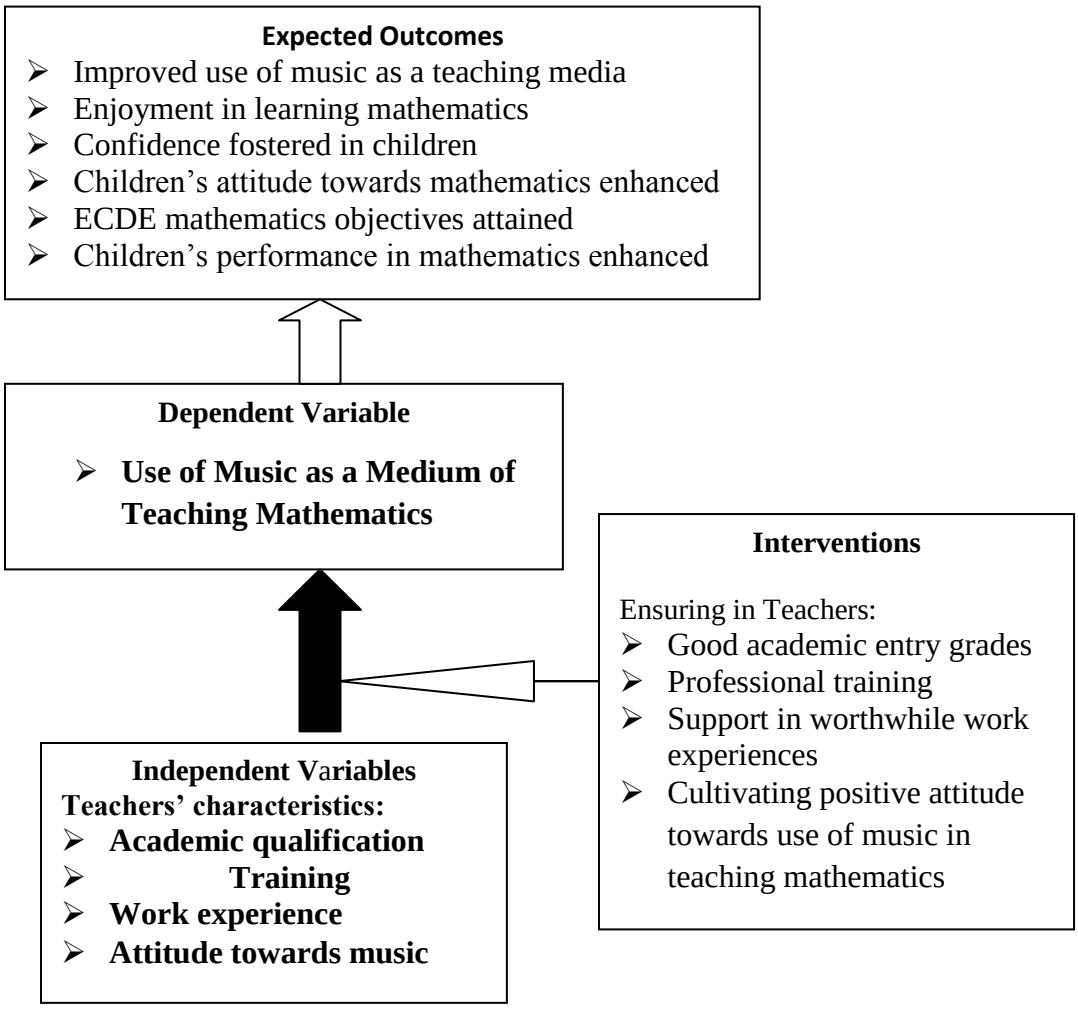
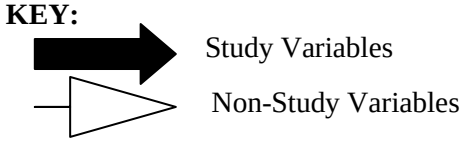


Figure 1.1 Influence of Preschool Teachers' Use of Music in Teaching Mathematics



As figure 1.1 shows, the dependent variable was use of music as a medium of teaching Mathematics while the independent variables were the teacher factors or attributes; namely their academic qualification, professional training, work experience and attitude towards music. It was postulated that the teacher factors had potential to influence the high or low frequency with which teachers used music or failed to utilise it while teaching mathematics.

Applying appropriate mitigation measures such as ensuring that teachers have good academic entry grades that candidates considered for employment as teachers were qualified and regularly in-serviced in how to use music in the teaching of mathematics, as well as cultivating positive attitude in them towards use of music in teaching mathematics was likely to lead to positive outcomes. Such outcomes could include; improved use of music among teachers as a medium of teaching mathematics, children would enjoy learning mathematics through music, learner's self-confidence would be fostered and their attitude towards learning mathematics as well as that of teachers in teaching the subject would be enhanced. In addition, increased use of music in teaching mathematics would lead to the realisation of ECE mathematics objectives and children's learning performance would equally be enhanced. If on the other hand there were no mitigation measures imposed on the teacher factors, the reverse would occur leading to negative effects.

1.9.3 Operational Definition of Terms

Academic qualification : Refers to the highest level/grade a teacher has attained, KCPE, KCSE, KCE, KACE, EACE, Certificate in ECDE, Diploma in ECDE and Degree.

Attitude : Refers to Preschool teachers' beliefs about music, feelings towards music and intentions to use music as a medium of teaching mathematics

Learning : Refers to the capability of a pre-school child to understand and comprehend new things and ideas in mathematics.

Music : Refers to activities which are pleasurable learning activity that involves singing and dancing by young children in preschool centres

Pre-school child : Refers to a learner between the ages of 3 and 6 prior to the commencement of formal education

Preschool Education : Refers to the initial education or instruction designed primarily to introduce young children aged 3 – 6 years to a school type environment.

Preschool teachers : Refers to the individuals teaching children aged 3-6 years.

Public schools : Refers to schools managed and maintained by the Nairobi County Council (NCC)

Teacher factors : Refers to attributes of teachers with regard to their academic grades, training, work experience and attitude.

Use of Music : Involvement of songs, rhymes and chants in teaching mathematics concepts

Work Experience : The number of years a preschool teacher has been teaching since leaving teacher training college.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.0 Introduction

This chapter presents literature review on important topics and studies related to the study. It covers the importance of music as a medium of teaching mathematics and factors influencing teachers' use of music in teaching mathematics namely teachers' academic qualification, training, teaching experience and attitudes towards music. The chapter ends with a summary of the literature reviewed.

2.1 Importance of Music as a Medium of Teaching Mathematics

A study by Garland and Kahn (1995), indicated that both Music and Mathematics were universally related, cut across cultural, historical and intellectual boundaries, and that music is grounded in mathematics while math is reflected in music. Music is an important medium for teaching young children mathematics because it is a pleasurable activity and naturally enjoyable. According to KIE (1990b), through music children relax and enjoy themselves, learn, sing new simple number songs/games and develop mathematical vocabulary as well as communication skills. Music similarly helps children compose their own number songs and movements, and they begin appreciating music early in life as requirements to not only learn mathematics but also as a separate and individual subject in later levels of school.

A study by Bobis and Bobis (2005), supports use of music in mathematics lessons by arguing that for teaching to improve, current views on music teaching must initially be brought to light. This is because children are the future and deserve quality education

that is not only informative but also relevant and interesting. Music engages pupils in a variety of milestones which includes; mentally, physically and emotionally. Brewer (1995), further noted that this link can create learning strategies which improve understanding of learning material. Music teaching has developed mathematics skills and concepts, children's willingness to participate and learn and enhances a conducive preschool environment. A study by Reif and Grant (2010), concluded that this has resulted to mathematics benefits connected to music including increased self-esteem and confidence, self-reliance, sense of achievement and ability to relate with others.

An experimental music study done by Bilhartz (2000) revealed that there was no correlation between exposing children to early music instruction and development of cognitive skills in specific non-music abilities. The experimental group in this study attained relatively higher scores on the measure of abstract thinking ability, that is, the Standford- Binet Bead Memory subtests. Involvement of parents and allocation of assignments outside the classroom reduced substantially in the Head Start program and among low and middle socio-economic populations. The experimental group which had the highest consistent parental involvement and sustained completion of allocated out-of-class assignments, attained the highest scores.

An increment in use of music during instructions attracted a corresponding increment in scores of abstract thinking capability. The results showed an identifiable trend of high scores correlating with improved social economic status this implied that higher social economic respondents had better compliance with the experimental conditions. Participants who had Kinder music exposure before this experimental study attained

higher results than children who had none or limited music education. There was no substantial influence of the Kinder-music-instructions on children abstract reasoning scores on the Stanford Binet intelligence test subsets.

Brewer (1995), added that music creates a conducive atmosphere, grounds positive learning conditions, develops a sense of anticipation, boosts learning activities, changes brain wave states, increases children's concentration in math, increases attention, improves memory, facilitates multisensory learning activities, releases tension, aligns groups, develops rapport, provides inspiration, enhances imagination and motivation, adds an element of enjoyment and accelerates theme oriented units. During the study, efforts were made to find out whether or not pre-school teachers in the schools sampled were aware of the importance of using music in the teaching of mathematics.

Johnson (2003), noted that the value of music to spatial reasoning creativity and other mathematical skills have long been established. Similarly, Jensen (2005), indicated that music strengthens the spatial reasoning essential to math skills. Berti (2006), and Pallesen (2010), argued that music enhances motor skills. Through singing and dancing, children use small acute muscles movements to write in mathematics and perform other physical activities essential for classroom learning. Sensory and motor function in the brain is developed through use of songs instruction.

According to Campbell (1998), music develops children's thinking skills. She pointed out that children think aloud through music and pupils are able to apply knowledge

and visualise solutions in mathematics. Music also increases mathematics achievement as pupils are able to perform well in math. The advantages that songs provide increase over time. Children sing songs while counting, playing, writing, colouring and drawing. All these math activities are enhanced and children are able to perform well in the subject. Children socialise more in play through singing and this makes them well integrated members of their communities. Songs promote social, emotional, mental and spiritual development of the child.

Kimetet al, (2010) believed that if teachers viewed music as an active tool for development and learning it was more often used. Likewise, where it was viewed merely as enrichment, less worth would be given to mathematics. According to Alexander (1988), early years of school noted a period of great importance in enhancing subsequent achievement in performance and creating interest in their learning through music is thus important.

Mutunga and Breakel (1992), mentioned that basic mathematical skills should be well known by adults to assist children in career opportunities, choices, household budgets, community programs and daily life management thus it is important for all members of the society to actively influence children's mathematical interest through music beginning at the foundation level in early childhood.

Brown (2001-2003) asserts that music is a universal language in timetabling and curriculum provision central to every culture of the world. This study covered vast and wide disciplines in schools from upper primary therefore the current study shall

replicate the same in preschools in Kasarani, Kenya. A study by Harkleroad (2006), notes that math and music have many concepts of instructions in common. For instance, patterns in the world can be expressed in symbolic language which is common to both music and math. This study assessed whether the mentioned music concepts are used frequently by preschool teachers in the Kasarani Sub-County ECD centres and how they influence mathematics teaching.

Maltester (1986).articulates that increased teaching in music results to increased learning in mathematics. Gardener (1983) adds that pre-schoolers often feel competent when they engage themselves in musical experiences in school like singing, dancing, drama or moving in response to music. When children develop music skills and understanding, they simultaneously develop basic intellectual, social and motor skills needed for success throughout the education cycle. This study assessed whether the mentioned music concepts are used frequently in the teaching of mathematics teaching and how they influence the learning of the subject. Johnson and Edelsen (2003), mentioned that integrating mathematics and music in teaching activities encourages learning but is rarely done by teachers. Music actively engages children in learning and helps develop key academic skills particularly in mathematics.

According to Merc (2008), great success and enjoyment has been achieved by many teachers using music to teach maths lessons. In the same way, Brown (2001-2003), adds that music makes learning better and more enjoyable. The study showed an example of how to integrate music and math: Favourite parts of a song, graph favourite characters, interesting facts and tally the numbers of characters in words.

According to Jensen (2002), there is a clear positive connection between music and math. This current study appreciated these studies' findings by adopting and modifying them.

Dodge and Heroman's (1999), study in West Africa publication of the Arts Education partnership noted connections between music learning and musical experiences, mathematical skills benefit directly from spatial reasoning skills. According to an article by Banoff et al., (2006) early intervention programs for children in mathematics have a positive impact on pre-schoolers' mathematics performance. Therefore, use of music or songs can enhance conceptual growth of children as they become creative and promote their imaginative skills.

Other findings revealed that only 3.4% of preschool teachers used thematic teaching approach. Digolo (1997), while undertaking a study to establish presence and use of music and movement materials in Nairobi, argued that in depth investigation should be conducted to establish the limitations that affect acquisitions and utilisation of music teaching and learning resources. The study showed that important teaching and learning resources for music education were either few or not available at all in most of the secondary schools. The inadequacy of the resources was recognised as a serious problem to students' learning and achievement. Lack of competence among some music teachers hindered proper utilisation of the instructional resources. These research studies have shown that music is a vital component in developing and enhancing mathematics teaching in ECDE. Preschool teachers should then make a

priority to improvise teaching and learning activities in music to enhance mathematics teaching.

2.2 Factors Influencing Teachers' Use of Music in Teaching Mathematics in Preschool

They include teachers' academic qualification, training, teaching experience and attitudes towards music.

2.2.1 Teacher's Academic Qualifications and Use of Music to Teach Mathematics

In a study conducted in USA, Barnett (2003), found that teacher academic qualification had a positive relationship with effective curriculum implementation. Further Barnett (2004), expounded that most industrialized countries have in place rigorous entry qualification for teachers in colleges. For example, in France, public pre-school teachers were required to have a minimum of a master's degree in education. America's preschool teacher's qualification are not standardized in terms of requirements, this is explained by the fact that there is no centralized teacher employment system. Each government agency and state that operates preschool programs has its own remuneration schemes and qualification for employment as kindergarten teacher. This study investigated whether academic qualification influences the use of music in teaching mathematics.

Resnick and Zill (2002), in a study of relationship of teachers' beliefs and qualifications to instructional practices in preschool programme in USA found that teachers with four-year degree qualification taught effectively in Head start

programme. The findings further revealed that better professional qualifications coincided with improved teaching and learning practices in the classroom. Moreover, other studies in USA have shown that pupils under the tutelage of a teacher with a bachelor degree qualification were involved in more music and creative activities than those taught by teachers with low professional qualification (Mkandiwe, 2010). According to Bowman, Donovan & Burns (2001) Teachers who taught children with both a bachelors' degree and training in child development and early childhood education were more sociable, displayed a more developed use of language and improved in cognitive tasks than children who were cared for by less qualified adults. The study established whether teachers academic qualification influenced their use of music in teaching mathematics in Nairobi pre-primary schools.

A study conducted by Makobi (2005), reveals that the majority (78.1%) of primary school teachers were P1 teachers, most of whom did not want to use music in teaching because they were not academically qualified to teach. Sidhu (1982), found one common problem in our education set up was that most teachers are not sufficiently qualified in the subjects concerned. Gumo (2003), reveals that there was an important positive relationship between the teacher's academic qualification and their quality scores in teaching Art and Craft. Teachers without proper qualifications fail to do justice to the subject and hence do not assist their children effectively. Moyles and Adams (2000), pointed out that teachers working in preschool must be well prepared academically, intellectually and in their personal and moral strength in matters related to their profession. Teachers with adequate and high academic qualification have self-confidence, self-esteem and act as a source of inspiration to the children he/she

teaches. This study investigated whether Nairobi pre-primary schools teachers have academic qualifications that influenced their use of music in teaching mathematics.

Olabode (2012) highlighted the effects of teachers' qualifications on performance of senior secondary school: implication on technology in Nigeria. The main objective was to determine whether the status of the teacher affected the performance of the students. The findings showed that students performed better when taught by professional teachers. However, the experience of the teacher is significant at impacting the child's academic performance. During the current study, efforts were made to find out how preschool teachers' academic qualifications influence their use of music in mathematics teaching in Kasarani, Nairobi County.

2.2.2 Teachers' Training and Use of Music to Teach Mathematics

According to Mugo (2009), teacher training strongly influences how well or not teachers perform their duties and are thus an important variable in this study. Teacher training ensures that the educator learns how to prepare lessons and to use appropriate teaching methods.

As mentioned earlier, requirements for preschool teachers vary worldwide. Whereas a minimum of a higher diploma is required for one to be licensed teacher for child care centres in USA, the minimum requirement for one to join the profession in France is a degree. Likewise in New York, one should attain a master's degree in 5 years after employment (Whitebook, 2003). A pre-school licensed teacher in Japan should hold at least a degree while in Kenya; the minimum is a certificate with an entry of grade D+

at O level (Republic of Kenya, 2006). This low level of qualification and entry has caused dissatisfaction among stakeholders, hence the researcher's impetus to investigate whether this level of training has an impact on use of music in teaching mathematics.

An online survey by Lee (2008), to establish music practices and teachers needs for teaching in public preschools in South Korea consisted of 42 questions, divided into seven categories according to question content. Majority of the teachers stated that their lesson plans had group music experiences more than twice a week, lasting less than 30 minutes on average. The most important reason named for including music in the curriculum was enjoyment and recreation. Almost all teachers planned music curriculum with a weekly theme and chose songs to match the theme. Singing and finger play were said to be the most often occurring activities in public schools. Teachers taught songs using a piano accompaniment by a CD, and some common CD collections for music activities were discovered. Rhythmic instruments were always accessible instruments in a music centre, but a piano was the most frequently used by teachers during circle time in the classroom. Teachers acknowledged lack of ideas for music activity in pre- primary schools as a challenge. The majority of members requested more applicable and thorough pre-service and in-service music education programs for preschool teachers.

A study by Oduolowu (2012), recorded that preschool teachers attending training used teacher-centred methods when teaching, of which music is part. It was also found that although preschool teachers used the new curriculum, they did so with minimal

materials and did not encourage hands-on activities in learning the contents of the curriculum. This however is inconsistent with Ngasike (2004), who asserted that training improved preschool teachers' ability to plan classroom teaching effectively and use of appropriate child-centred teaching methods. Nevertheless, the study discovered that only 10% of the teachers in Kasarani division used play teaching strategies in teaching mathematics skills to preschool children. This is because of lack of teacher training programmes provided to the educators, who are concerned with the subject contents only while in training. There was need for further study in Kenya and specifically pre-primary schools to reveal whether teacher's training have a relationship with the use of music in teaching mathematics.

On a more positive note, Office of Technology Assessment (1995), indicates that strategies like appropriate and timely training, expertise to support and help teachers and time for teachers to learn, experiment with technology and work increases the use of technology in teaching. For preschool teachers to use music as a medium of instruction in teaching mathematics, they must have relevant knowledge and skills and receive proper training to equip them to meet this goal. This study explored preschool teacher's training on use of music in teaching mathematics in pre-primary schools in Nairobi.

In a study by NACECE (2002), results showed that the training teachers received affects the way they teach preschool children. Trained teachers have a positive relationship with the learners and also socialize well with them as they use the instructional materials (Homes, 1997). There is need for preschool teachers to undergo

intensive training so that they can get equipped with knowledge and skills to cope well with the demanding nature of young children (Munyeki, 1987). The study further adds that when preschool teachers are trained they are in a better position to provide learners with appropriate materials during teaching. There was need to ascertain whether teachers training have a relationship in influencing the use of music in teaching mathematics.

According to Mwololo, Koech, Begi and Mutweleli (2012), on preschool teacher's knowledge and attitudes towards use of visual media, trained preschool teachers frequently used visual media than untrained teachers. The study concurs with Aila (2005) that trained teachers used instructional visual aids more often than untrained teachers. The studies focused on the aspect of trained and untrained teachers while the current study will focus on how the teachers' level of training affects the use of music as a medium of teaching mathematics in preschool schools.

Teachers' level of training and qualifications is essential in determining the teaching process. This is because teachers influence the use of music in teaching mathematics as well as detecting any problem associated with teaching and learning in the classrooms. Rotumoi (2012),explored factors influencing the choice of approaches used by preschool teachers in Baringo county, where majority of teachers were O level/KCSE holders, followed by A level then diploma holders, CPE/KCPE and degree holders, who were the least in number. The study looked at how teachers' level of training affected the choice of approaches used in preschools, while the current

study will look at how the teachers level of training affects use of music as a medium of teaching mathematics in preschool schools.

According to Kinuthia, Kombo and Mweru (2013), administrators preferred to hire teachers with low levels of qualification so that they can pay them low wages as opposed to degree holders, whose pay would be significantly higher. This was confirmed by the numbers as 71% of the teachers were trained, 23% were undergoing training and 4% were not trained. Of these, 66% were certificate holders, 15% were diploma graduates while 4% held a degree. A similar study by Muyoka (2012), revealed that 25 (65.8%) of the teachers had undergone certificate training, 12 (31.6%) had a diploma and 1 (2.6%) had a degree in ECDE. The results show that all the teachers were professionally qualified hence competent in teaching ECDE children. However, the study did not focus on how these competent teachers could use music as a medium of teaching mathematics in preschools; therefore this lays the foundation of this study.

Lack of knowledge and skills inhibit preschool teachers' chances of showing and teaching learners how to use music in mathematics teaching. A study done by Wambui (2013), on effect of use of instructional materials on leaner participation in science activities in preschool classrooms in Kiine discovered that out of 30 participants, 10 (33%) were diploma holders, 15 (50%) were certificate holders while 5 (17%) were untrained teachers. It was also found that instructional materials are underused in the area of study. One of the reasons attributed to this was lack of professional skills. The teachers in this study location were not highly qualified since the highest level of

education was a diploma, while other teachers were not trained. The study concentrated on science activities in preschool classrooms while the current study will investigate how the level of training affects use of music as a medium of teaching mathematics in preschool schools.

2.2.3 Teaching Experience and Use of Music to Teach Mathematics

A study by Ankers, Lamas and Tonyoy (2005) emphasised that in order for the teacher to have adequate exposure to the teaching world of work, the field based experience needs to be of sufficient duration. According to Arnett and Freeburg (2008), teachers are ill prepared for the world of work and the professional competency of teacher is deficient, with unsatisfactory content knowledge, bears weakness at teaching practice and graduates are not up the standard. In order to fill these identified gaps, the teaching experience came into existence and many literature reviews argue that the best way to educate teachers is to give them real experiences of school. MOE (2003), led to the introduction of a practicum in teachers' education through which student teachers understood the social-cultural, political and economic factors underpinning education. Therefore, teaching experience among the educators is a very important part of a teacher education program.

The education of young children should take into the account the increasing experience of the teachers (Dewey, 1982). This implies that preschool teachers need to be well trained and experienced to meet all the developmental and educational needs of young children. Preschool teachers are supposed to support, inform, inspire, listen to and respect children during the teaching and learning process. This can be made

possible through provision of adequate materials from the local environment, especially in music instruction.

The number of years that a teacher has in the teaching profession influences the use of relevant instructional resources during instructions. According to Ngure (2014), on utilisation of instructional media in preschool teachers training college, the predominant number of tutors had a teaching experience of over three years. The study further confirmed that most tutors were well equipped to prepare and utilise instructional materials in teaching due to the long years of service in the teaching profession. Adegbija and Fakomogbon (2012), confirmed that the experience teachers' had with teaching materials in Nigeria through teacher improvement programs and fresher training correlated with utilisation of instructional resources in the classroom. Another study on improving and enhancing teachers' capability to choose, develop and utilize teaching resources for effective classroom instructions in Nigeria, similarly, reported that the skills acquired by teachers with many years of exposure to instructional materials prepared them to produce and utilise instructional media (Onasanya, 2006). The above studies did not shed light on how the teaching experience influenced the use of music as a medium of instruction in teaching mathematics and which is what this study was mandated to investigate.

It was also observed that teachers who are more experienced in ECDE have a positive relationship with preschool children as compared to those who are less experienced (Homes, 1997). According to Cassa (1990), preschool teachers who are well experienced are seen to be more confident in dealing with young children and are also

more effective in their teaching. This is because they have acquired a lot of skills in teaching young children and are therefore in a position to tackle the teaching process better. Sidhu (1982), observed that successful teaching experience is very important and enables the teacher to acquire professional characteristics such as promptness, adaptability, efficiency, arousing and maintaining children's interest, provision of adequate instructional materials and the ability to face the class with confidence. Thus the teacher with enough working experience will be better able to choose appropriate teaching learning materials. This study focused on the relationship between the level of teaching experience and the frequency of use of use of music in teaching mathematics.

Mugo (2009), similarly emphasised on the importance of experience on the way a teacher executes his/ her work. She further states that the more years a teacher has in their job, the more opportunities they get to practice or teach. Gumo (2003), also found that there was a significant positive relationship between the number of years the teachers had worked and quality scores in teaching. Lawrence (2005), further notes that teaching experience is a significant basis for further professional development of a teacher since the educator extensively draws from his or her experience to increase their efficiency and to counter problems met. In a case study in Kisumu North East and West districts, Ajowi, Simatwa and Ayondo (2011), reported that teachers with less than five years of experience prefer lesson observation more than the experienced teachers. Older teachers (over 30 years) felt they are experienced and capable of teaching without supervision.

Makobi (1985), on the contrary found that teachers who have taught for many years did not cover music during training. In addition, a study done by Waigera (2013), on relationship between use of culturally relevant instructional materials and teaching experience found that 5% of teachers had less than a year of teaching experience, 20.4% had 1-5years of teaching experience while the remaining percentage had over 6years of teaching experience. The study clearly showed that the teachers preponderantly were well experienced with over 6 years of teaching experience. The study further found that teachers' teaching experience and their use of culturally relevant instructional materials have no significant relationship. Similarly, a study by Rotumoi (2013), revealed that 17% of teachers have 0-5years of teaching experience while 66% have 6-10years of teaching experience, the rest (17%) have between 11-15years of teaching experience. Many of the teachers in the study location had over 5years of teaching experience. Regardless of teachers having this significant experience, they failed to effectively use teaching materials in the course of instructions. This was of concern and led to conducting this study with the aim of finding out if similar cases were happening in preschools. This was established by focusing on how teaching experience affects the use of music by teachers in teaching mathematics.

A study done by Kinuthia, Kombo and Mweru (2013), on determinants of preschool teachers attitudes towards teaching revealed that there is low level of training among preschool teachers. Those with few years of working experience were the ones that participated in the teaching process. The current study investigated how the preschool

teachers teaching experience level impacts the use of music in mathematics instruction.

2.2.4 Teacher's Attitude and Use of Music to Teach Mathematics

Observations made by Fortin (2013), at Peace chapel from New Zealand suggested that some of the most powerful people in the development of young children are teachers. Student growth is impacted by the way teachers structure their lessons. A good and bad teacher influences students' attitudes towards classroom, learning and their study habits. Teachers with more musical background are more at ease when teaching mathematics in the classroom (Harkleroad, 2006). Concurring to Hash (2009), instructors are still attentive of taking on duties. Whitecomb, R. (2012) carried out an overview to decide the nature of melodic exercises in preschools in an urban locale of the Joined together States, the degree to which music is mixing in preschools and current educator states of mind with respect to the execution of music in preschool instruction. It built up 66 preschool instructors totalling to 98% of members pointed out they included music whereas educating with 78% detailing that melodic exercises happen in their classrooms each day. Commonly detailed melodic exercises executed by preschool instructors were singing tunes (100%), playing beat rebellious (95%), moving to diverse sounds and rhythms (93%), playing pitched rebellious (83%), and utilizing creative ability and inventiveness to precise oneself through music and move (74%).

Attitudes with respect to music were found to be ideal, with all respondents showing that music taught to be included frequently in preschool. A soften as possible as

possible detailed helping variables for counting music were in service preparing in music instruction (94%), proficient conferences (92%), shows by music pros and summer workshops (88%). As often as possible detailed repressing components were a need of preparing to educate music, (48%), monetary imperatives for the of melodic materials (46%) and a need of arranging/planning the (42%) discoveries of the ponder shown that preschool instructors concurred to back the consideration of music in instructing, have included music in their classrooms, and would welcome proficient advancement openings based on music. When this is considered, music specialists can play a role in helping preschool teachers by providing illustration of musical activities and cooperating with preschool personnel to ensure the addition of developmentally appropriate music practices in teaching during training.

A study by Vannatta-Hall (2010), on the impact of music methods course on pre-service early childhood teachers' confidence and competence to teach music investigated whether there was a significant change in participants' perceived self-efficacy to teach music following the completion of a 15 – week music method course. The study focused on environmental and interpersonal influences on confidence and competence to teach music by examining the sources of self-efficacy (mastery experience, vicarious experience, verbal persuasion, and physiological and effective states) within the context of a university music methods course for 41 early childhood pre-service teachers in which the researcher was also the course instructor.

Changes in self-efficacy perception were shown according to each course of self-efficacy. Results showed a great overall increase in student self-efficacy scores over time. The major influential source of self-efficacy beliefs was inactive mastery experience, exemplified by prior music experiences as well as independent teaching experiences throughout the semester.

Vicarious experiences included observations of both a music specialist and peers teaching music. Verbal persuasion included feedback from both the course instructor and the children the students taught for their practicum. Finally, physiological and effective states were exemplified by participants' music anxiety, and to a lesser degree, stress and fatigue. The results of the study demonstrates how important it is for a pre-service generalist to develop the will (self - efficacy) and the skill (competence) to teach music if they are to develop the competencies needed to provide adequate music opportunities for their future students. This study investigated the relationship between preschool teachers' attitudes towards music and use of music as a medium of teaching mathematics.

A paper written by Handal, Bobis, and Grimison (2001),on teachers' knowledge beliefs and practices about the integration of mathematics and music recorded that many primary teachers with similar expertise did not report using an integrated approach to teaching. What seemed more revealing of a teacher's decision to use integrated teaching was their belief that such an approach would assist students develops a deeper understanding of the concepts taught. The case study also revealed how complex teaching through an integrated approach can be in preschools, especially

as teachers move in and out of such an approach or are required to use a less sophisticated form of integration for various reasons.

Quality on serving of teachers however could assist those with similar problems of integrating music when teaching mathematics. Therefore there is need to conduct further study on other factors in use of music as a medium of teaching mathematics and find out the condition in public pre-schools.

A study by Bariseri (2000), on primary student teachers' music education in England and Turkey examined the generalist PGCE and specialist B.Ed. students' attitudes and confidence towards primary music teaching before and after their teacher education courses. It also investigated the 3rd and 4th generalist student teachers' attitudes and confidence towards primary music teaching. English students' attitudes towards music teaching are based on three factors: -

(i) Confidence in pedagogical content knowledge

(ii) Beliefs about value of music

(iii) Enjoyment of teaching music

The Turkish students' responses on attitude statement created four factors:

(i) Confidence in content of music

(ii) Teaching role and beliefs to the value of music

(iii) Confidence in pedagogy

(iv) Enthusiasm for music teaching

Turkish students tended to separate their pedagogical confidence from their subject knowledge confidence, whereas these aspects were merged for English students.

In contrast to the Turkish teacher education course, the PGCE course increased students' confidence in their pedagogical knowledge and in creative activities at the end of the course. Third year Turkish students were more confident in their musical and teaching knowledge and had more positive beliefs about the value of music education than the 4th year students. Lack of time for music teaching practice and class management problems were revealed as the main challenges to the development of students' confidence to teach music further. This study will focus on the influence of preschool teachers' attitudes on the use of music in teaching mathematics.

Pietra, Cruz, Bindery, and Devaney (2010),investigated the attitudes of elementary school teacher trainees' towards integration of music as a teaching strategy and the relevance of music in the primary school curriculum as they prepared for entrance into the profession at a time when rigorous testing, standardization and accountability were highly emphasized on. In particular, the study examined attitudes towards; integration of music into the syllabus, the educational and social advantages of music instructions, and the ease of teaching and learning music during instructions. The study findings showed a significant correlation between initial musical exposure and the significance of positive responses.

According to studies by Birge (1988), and Gray (2000), generally pre-primary and primary teachers have traditionally have taken the initiative and responsibility of introducing musical education to children. To prepare them for this task, teacher

training institutions have historically had music training integrated as part of teacher professional training. However, although teachers' musical training is essential, it is often treated as a least important element during pre-service training hence very limited (Stein, 2002). Limited training and less emphasis by teacher trainers negatively affect teachers' attitudes toward music use during syllabus coverage.

Weller (1991) investigated the subordinate treatment of elective activity areas, for example, music. Respondents in the study evaluated such subject areas with a negative attitude. The identified devaluation had a significant influence on music syllabus coverage and instructions initial years of high school as students had not decided which electives to specialize in. Similarly, Stein (2002) noted that preschool and primary school teachers' attitudes toward music instruction is valid pointer of the relevance they attach to the significance of music instructions and the way in which they support use of music as a medium of instruction.

Current research reports on attitudes of pre-primary and primary instructors focus on, one, teacher trainees' attitude development through exposure to specific pedagogical courses (Kretchmer, 2002; Siebenaler, 2006), two, teacher trainees' attitudes toward music-course-content which influence attitude alteration in favour of music instructions (Colwell, 2008; Stein, 2002), three, practicing preschool and primary teachers' attitudes related to national standards of teaching music (Byo, 1999; Colwell, 2008), four, in-service primary schoolteachers' attitudes toward the music-subject-content and how it relates to actual music use in the classroom. (Gray, 2000), five, the connection between utilization of music as a medium of

instruction and music method-course-curriculum (Propst, 2003), and six, musical situations organized by experienced preschool classroom teachers (Giles & Frego, 2004).

Results of these studies are in agreement that music pedagogical teacher training may or may not have direct influence on how teachers integrate music in the instructions (Kretchmer, 2002; Stein, 2002). Experienced teachers do not consider standards-based music teaching to be within their professional capability (Byo, 1999). Thus, the current study investigated whether attitudes affects the use of music as a medium of teaching mathematics in preschools in Kasarani Nairobi City County.

Eshiwani (1984), states that through in depth investigation, teachers beliefs and attitudes will change. This will improve their teaching experience and professionalism. Many parents and community members involved in Education are concerned about the current low level of achievement in mathematics in lower primary school. Preschool teacher's attitudes towards music affect the use of music in teaching mathematics.

Watt (2000), examined the teaching of music in primary schools in Zimbabwe by non-specialist and the extent to which non-specialist primary class teachers were able to teach music to children. The findings stated that primary school teachers were less confident to teach music than other areas of curriculum. Hence the study will investigate preschool teachers' attitudes towards use of music in teaching mathematics in Kasarani division.

Odongo (2009), compared teachers' attitudes on their use of music as a medium for enhancing development in all early childhood aspects in Kenya and United States of America. Results centred on strategies used to teach music, the role of music in early childhood curricula, instructional approaches used for example singing and movement and use of musical instruments. Therefore, there is need to conduct further study.

Factors affecting music in Kenyan education in primary schools revealed that the majority of the teachers did not want to use music during lessons because they were not trained on how to use music in teaching. This meant that teachers had negative attitude towards music. A study by Shiundu (2000), in music teaching in selected pre-schools in Nairobi province established that lack of interest in music was one of the reasons which delayed the use of music in teaching. Mugo (2009), found that pre-service teachers held relatively strong beliefs about the use of music including aesthetic, quality of life and social emotional benefits. Olabode (2012), stated participants have limited attitude of music content in general and higher musical knowledge predicted strong beliefs about its benefits. The survey also found out that the teachers' attitudes on music influenced the importance they gave mathematics. In depth content knowledge in at least one of the subject areas being integrated was a common trait among primary school teachers. This study determined the relationship between preschool teacher’s attitudes towards music and use of music on mathematics teaching in Kasarani, Nairobi, City County.

2.3 Summary of Gaps of Knowledge

Reviewed of related literature had revealed the following gap of knowledge that this study filled firstly, the reviewed studies established that the use of music as a teaching-aid during mathematics lessons was inadequate in preschools and majority of the studies focused on secondary and primary schools while leaving out preschool level, hence there was need for use of music in teaching mathematics in preschool schools. This is because music promotes children's competence, enhances their thinking, enables children to understand culture, enables children to relieve their feelings and emotions, develops their communication skills and improves ability to solve mathematics problems.

Secondly, the literature review further revealed that preschool teachers' training, academic qualification, work experience and attitude towards music significantly affected the use of the medium in teaching mathematics but failed to address how they affected the use of music in teaching mathematics in preschool classrooms. The study determined the frequency of use of music as a medium of teaching mathematics and linked them to factors that affected its use such as teachers' academic qualification, training, experience and attitude towards music in Kasarani, Nairobi County.

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

3.0 Introduction

The chapter covers the design of the study, variables of the study, location of the study, target population, sampling technique and sample size. The research instruments, piloting study, data collection technique, data analysis and logical and ethical considerations also consist the content of this chapter.

3.1 Research Design

The descriptive survey design was used in this study. This is because it makes use of both qualitative and quantitative data to describe the state of affairs as they exit in the field. This design is simple and easy to execute yet can yield convenient information needed by the study (Muijs, 2004). The design was also deemed appropriate for use because it relies on individuals' reports of their knowledge, attitudes or behaviour. It assesses attitudes, opinions, demographic information and procedures (Ary Jacobs, & Razavieh, 2002; Creswell, 2009). Descriptive design was similarly appropriate because it enabled examination of the nature of use of music in teaching mathematics. It also assessed teacher’s demographic information and attitudes towards use of music in teaching mathematics.

3.2 Variables

The independent and dependent variable were as follows:

3.2.1 Independent Variables

Independent variables were factors that influence teachers' use of music in teaching mathematics and will be measured as follows:

Teachers' level of Training: This was measured by asking the preschool teachers to state their highest level of training namely: ECDE certificate, diploma, or university degree.

Teacher's Experience: This was measured through finding out the number of years one had taught as a preschool teacher since training, specifically below 5years, 6-10 years and above 10 years.

Academic Qualification: This was measured by establishing the preschool teacher's highest academic level: primary education certificate (KCPE), secondary education certificate (KCSE).

Teacher's Attitude: Preschool teachers' attitude was measured with regard to how positive or not they were towards use of music as a medium of instruction in teaching mathematics using a four-point Likert scale: very positive, positive, negative, very negative.

3.2.2 Dependent Variable

The dependent variable was the frequency of use of music in teaching mathematics by preschool teachers. The researcher established the extent of use of music during mathematics instruction using a four-point Likert scale; very great extent (4), great extent (3), little extent (2) and not at all (1).

3.3 Location of the Study

Kasarani Sub-County was the study location of this study. Studies conducted in this Sub-County have shown that pupils in public primary schools are performing poorly in mathematics compared with other Sub-Counties in Nairobi as reported by Uwezo Kenya (2012). In addition Kasarani sub-county has also shown low achievement in Mathematics (County Education Office, 2017). Kasarani Sub-County exam analysis indicated differences in performance of mathematics, which may be attributed to the strategies used by teachers in teaching the subject including those in the preschool section. Also, the head teachers and teachers working in the schools are drawn from all over the country. The Sub-County was also considered due to its diverse residential areas which range from upper, middle to low classes, for example, Muthaiga, Thome, Githurai, Marurui and Mathare. Diverse residential areas ensure availability of a variety of songs that are readily applicable in mathematic instructions.

The researcher was also compelled to choose this location because studies available locally had not paid much attention on the relationship between teacher's factors and the use of music in teaching mathematics in pre-primary schools. The constituency has two educational zones, Roysambu and Ruaraka. Kasarani Sub-County was selected due to its cosmopolitan nature as it has all types of ECD centres that are representative of the Kenyan pre-primary schools in terms of music cultural diversity and multiplicity of teacher characteristics.

3.4 Target Population

The target population of the study was all the public preschools, preschool teachers and head teachers in Kasarani Nairobi County. Kasarani sub county has 30 public preschools with an average of 3 teachers per school based on these statistics the researcher targeted 90 preschool teachers;30 head teachers in all the 30 public pre-primary schools..

3.5 Sampling Techniques and Sample Size

In order to obtain the sample size, various sampling procedures were involved as explained.

3.5.1 Sampling Techniques

In this study, the researcher used multistage sampling to select appropriate sample size it entails two or more stages of random sampling used as follows:

i) County/ Sub County:

Purposive sampling was used to select public primary schools in Nairobi County and Kasarani Sub-county because it helps in identification and selection of information-rich cases for the most effective use of limited resources (Patton 2002). This involves identifying and selecting individuals or groups of individuals that are especially knowledgeable about or experienced with a phenomena of interest (Cresswell & Plano Clark, 2011). In addition consistent poor performance in Mathematics in Karasani Sub-county has been reported which could be attributed to the techniques and methods used in teaching this activity by teachers including those in preschool schools.

ii) **Pre-schools:**

Out of the 30 public preschool schools, 15 (50%) of them were randomly selected by rotary to avoid bias. Thus thirty pieces of papers bearing numbers 1 to 30 were folded then put in a box. After thorough shaking, 15 papers were picked and the preschools bearing the picked numbers on the list constituted the sample. The study used 50% of the population to enhance generalisation of study findings.

iii) **Head Teachers:**

Fifteen head teachers of the selected public preschools in Kasarani Sub-county were automatically selected.

iv) Preschool teachers:

As for preschool teachers, 45 (50%) of them out of the 90 targeted were purposively selected for study.

3.5.2 Sample Size

The sampling size is presented in table 3.1 below.

Table 3.1 Sampling Frame

Items	Target Population	Sample (50%)
Public Preschools	30	15
Headteachers	30	15
Preschool teachers	90	45

As Table 3.1 indicates, the sample size consisted of 30 (50%) public preschools including their head teachers and 45 (50%) preschool teachers. With reference to Mugenda and Mugenda (2003), a 10% - 30% sample size or more in situations where target population is small is permissible for study to obtain adequate representativeness.

3.6 Research Instruments

Questionnaire was used to collect data from teachers and head teachers. Questionnaire was used because it has greater anonymity and gathers data over a large sample. It is also convenient to administer as they are left with respondents to respond at their convenient time. It comprised a questionnaire for preschool teachers (Appendix 1A), as well as one for head teachers (Appendix 1B) and an observation guide (Appendix 1C) used during mathematic instruction.

3.6.1 Questionnaire for Preschool Teachers

This instrument comprised of six sections (see Appendix 2A). Section A involved demographic information about the teachers. Closed ended questions were used to collect data on teachers' age bracket and gender. Section B comprised four Likert scale questions that sought to assess the extent to which teachers used music during mathematic instructions. Section C measured preschool teachers' training in use of music during mathematics instructions.

Section D determined the extent to which preschool teachers believed that their attitude was positive towards use of music in teaching mathematics. It comprised of a

four-point Likert scale ranging from very positive to not positive at all responses. Use of the questionnaire was preferred due to its ease in collecting data from different study participants simultaneously thus saving on time. It also ensured that they answered the questions at their own convenient time without undue pressure.

3.6.2 Questionnaire for Headteachers

The questionnaire was made up of two sections; A and B. Section A helped to confirm preschool teachers' demographics while Section B established their use of music to teach mathematics and how the preschool administration supported them. Questionnaires for head teachers were suitable because they were administered to them alongside preschool teachers during observations thus did not take much time (see Appendix 2B).

3.6.3 Observation Guide

A participant observation guide was used to collect information directly by observing and recording the current state of preschool teachers' use of music during the math lesson in public pre-primary schools and to ascertain the responses involving the influence of their level of academic qualification; training, work experience and attitude towards the extent to which they used music as a medium for teaching mathematics (see Appendix 2C).

3.7 Piloting of Study tools

Piloting of research instruments was done in four public pre-schools using eight preschool teachers. The pilot study did not include any private school because the

researcher was to collect the data from public pre-primary schools in Kasarani sub-County due to the poor mathematics performance that had been reported in this area (Uwezo, (2012) The pre-schools involved in the pilot inquiry were not part of the sample of the study because they already had been exposed to the investigation and thus were familiar with the questionnaire items.

The pilot study was conducted with the objective of testing the suitability of the study items to preschool teachers in order to improve them and to enhance validity and reliability of data collection instruments. It was also a way of checking for adjustments necessary in order to work out the unforeseen obstacles before the main study.

3.8 Validity and Reliability

Section 3.8 discusses how validity and reliability of research instruments was ensured.

3.8.1 Validity of Instruments

Questionnaire in this study was based on objectives stated in this study. Mugenda and Mugenda (1999) define validity as the appropriateness of the instrument in measuring whatever it is intended to measure. Pilot study helped to improve the face validity and content of the research instruments. The researcher sought assistance of the supervisor and other university lecturers, who, as experts in research methods and education, assisted in enhancing validity of the instrument. According to Borg and Gall (1989), validity of an instrument is improved through expert judgments. The feedback from the experts was used to enhance and adjust the research instruments. For instance,

ambiguous items were removed and more other valuable items related to research objectives were adjusted to enhance the content of the instruments.

3.8.2 Reliability of the Study

Split half method was used whereby the instruments were administered to eight preschool teachers and four head teachers once and the scores split into two equal halves then correlated using Pearson product moment correlation test (see Table 3.2).

Table 3.2: Split-Half Reliability Coefficient for Teachers' Questionnaire

Sections	**Items per section**	**Reliability coefficients**		
		1st half	**2nd half**	**Average**
Section A: Demographic information	2	0.74	0.73	0.74
Section B: Use of music to teach mathematics	5	0.81	0.79	0.80
Section C: Teachers' academic qualifications	2	0.76	0.75	0.76
Section D: Teachers' Training	5	0.78	0.71	0.75
Section E: Teachers' Experience	2	0.71	0.75	0.73
Section F: Teachers' attitude	10	0.74	0.76	0.75
Total Items	26	0.76	0.75	0.76*

* Overall reliability coefficient

Table 3.2 on Pearson product moment test shows the two sets of scores for the preschool teachers' questionnaire items were highly correlated. Further, the overall computed coefficient of 0.76 was obtained and the instruments judged as reliable as per Mugenda and Mugenda (1999), who advised that a coefficient above 0.7 was acceptable. Where items fell short, adjustments or modification were made to improve

them, or if not found useful they were completely discarded. Table 3.3 presents the reliability test results for head teachers' questionnaires.

Table 3.3: Split-Half Reliability Coefficient for Head teachers' Questionnaire

Sections	Items per section	Reliability coefficients		
		1st half	2nd half	Average
Section A: Demographic information	4	0.88	0.82	0.85
Section B: Use of music to teach mathematics	5	0.70	0.68	0.69
TOTAL ITEMS	9	0.79	0.75	0.77*

* Overall reliability coefficient

Pearson product moment test (Table 3.3) indicates that the two halves of scores for the head teachers' questionnaire items were correlated. Furthermore, the overall coefficient obtained, that is 0.77, indicated that the research instruments for head teachers' questionnaires were reliable as the minimum acceptable level of coeffieciency proposed earlier in the study was 0.7.

3.9 Data Collection Techniques

The researcher obtained research permit from National Commission for Science, Technology and Innovation and area education officer in the area. The investigator visited the area to get a better understanding of the Sub-County both demographically and geographically. The researcher introduced himself to the teachers and sought their consent for data collection Simple random sampling of the pre-primary schools was done from which teachers and head teachers were selected. After going through the consent form the teachers were issued with consent to sign indicating their willingness to participate in the two stages of data collection. The researcher in collaboration with

the teachers planned on the date for carrying out the research which was to take place for one month every day before 11:30a.m. Data was collected in 2 stages:

Stage 1: The Questionnaires were administered directly which involved the distribution of questionnaires directly to the respondent and waiting until the respondent completed. Before collecting the filled questionnaires the investigator checked errors in order to achieve reliable results.

Stage 2: The investigator conducted observation and recorded the state of preschool teacher's use of music during maths lesson in public pre-primary schools and to ascertain the responses involving the influence of their level of academic qualification; training, work experience and attitude towards the extent to which they used music as a medium for teaching mathematics.

3.10 Data Analysis

The researcher used both the qualitative and quantitative analysis of the data obtained. Qualitative data was organized into themes & reported according to research objectives.Quantitative data wasanalyzed descriptively using means, frequencies & percentages and presented using frequency tables, bar graphs and pie charts.Quantitative data was first coded, assigned labels according to study variables and presented using frequency tables. This was done to ensure accuracy, consistency, uniformity, and identification of illegibility. The tabulated and classified data were according to the study objectives.

Inferential statistics were calculated and tested using Chi-square test. The chi square was used to establish whether or not there was significance difference between the two variables. The dependent variable (use of music as a medium in teaching mathematics) and independent variable (factors that influence teachers use of music in teaching mathematics: teacher's level of training, experience, academic qualification and teacher's attitude towards the use of music in teaching mathematics. Chi-square was also used because the independent and dependent variables in the hypotheses were categorical. Results were presented using tables, texts and organized according to objectives that guided the study.

3.11 Logical and Ethical Considerations

The Section 3.11 presents the logical and ethical issues put under consideration during the study.

3.11.1 Logical Considerations

Following a successful presentation of the proposal from the Department of Early Childhood Studies, the researcher ensured that procedures in data collection were adhered to by preparing enough questionnaires for the teachers. The researcher also obtained a letter of authorization to collect data in Kasarani public preschools from relevant authorities that include: Kenyatta University graduate school, Kenyatta University Ethics Review Committee (KU-ERC) and National Commission for Science and Technological Innovations (NACOSTI).In addition, the researcher also ensured that materials used in data collection were prepared and made available during data collection. Finally, the researcher planned and allocated finances for transport and

other personal emolument during data collection. The researcher was given authority to visit the sampled schools. There after permission was sought from Kasarani education officer.

3.11.2 Ethical Considerations

Once at the learning centres, the researcher visited the preschool teachers after seeking permission from the head teachers. The researcher ensured that ethical issues were upheld. First, the researcher ensured that the information given was strictly used for academic purposes. Therefore, approval for this research was obtained from relevant bodies such as the Kenyatta University and Department of Education at the County Government of Nairobi. Secondly, preschool teachers' concurrence to participate in the study was sought and they signed a consent form. Lastly, Anonymity and confidentiality were upheld by ensuring that the respondents did not write their names or other personal details on the questionnaire.

CHAPTER FOUR

PRESENTATION OF FINDINGS, INTERPRETATION, AND DISCUSSIONS

4.0 Introduction

This chapter presents the results of the study findings, their interpretations and discussions. It provides information on the use of music as a medium of teaching mathematics in preschools in Kasarani, Nairobi City County, Kenya. It begins with the demographic data of the respondents, thenresults of the study findings based on the four research objectives that guided the study as follows:

i. To establish the influence of preschool teachers' academic qualification and their use of music in teaching mathematics.
ii. To determine the influence of teachers' level of training and their use of music in teaching mathematics.
iii. To find out the influence of teachers' level of work experience and their use of music in teaching mathematics.
iv. To determine the influence of teachers' attitude towards music and their use of music in teaching mathematics.

4.1 General and Demographic Information

The study was interested in finding out the demographic information of the teachers relating to their gender, age, academic level, and teacher's experience. The purpose of this information was to establish the questionnaire return rate, background information of the respondents and their ability to report on the use of music as a medium of teaching mathematics in preschools in Kasarani, Nairobi City County.

4.1.1 Questionnaire Return Rate

To establish the success of the data gathering process, the researcher established the preschool teachers' questionnaire return rate. The results are presented in Table 4.1.

Table 4.1 Return Rate

Indicators	**Frequency**	**Percent**
Response	45	100
Non-response	0	0
Total	**45**	**100**

Results presented in Table 4.1 shows that the study attained maximum questionnaire return rate. This may be due to the use the drop-and-collect-later technique of questionnaire distribution.

4.1.2 Teachers' Gender

Although gender was not a study variable, the study deemed it important to establish the gender of the educators to find out the general prevalence of male and female preschool teachers in Kasarani Sub-County. The results are presented in Table 4.2.

Table 4.2 Proportion of Teachers' by Gender

Gender	**Frequency**	**Percent**
Female	42	92.6
Male	3	7.4
Total	**45**	**100**

Table 4.2 indicates that majority of the preschool teachers who participated in the study were female, numbering 42(92.6%) while 3(7.4%) were male. These study findings reflect a similar observation by Githinji (2011), who found that preschool teachers were typically female (88%) with the remaining 12% being male. Similarly, Mudaki (2011), while undertaking a study on supervision of Early Childhood Development and Education programs in Nairobi province evinced that 88% of preschool teachers were female, while 13% were male. These findings may imply that male educators preferred to teach in levels other than preschool.

4.1.3 Teachers Age

Teachers' age is viewed as a key indicator of maturity and experience in all general aspects of growth and development including musical exposure within the social-culturalenvironment. The results of age brackets of preschool teachers in Kasarani Sub-county are presented in Table 4.3

Table 4.3 Proportions of Teachers' Age

Age range		**Frequency**	**Percent**
Valid	Very Young (20-30)	6	13.3
	Relatively Young (30-40)	21	46.7
	Relatively Old (40-50)	10	22.2
	Old (50 and above)	8	17.8
	Total	**45**	**100.0**

The findings presented in Table 4.3 indicate that the highest number (46.7%) of preschool teachers in Kasarani Sub-County was in the relatively young (30-40 brackets), followed by 22.2% of preschool teachers who were relatively old (40-50). These were then followed by old (50 and above) at 17.8% and the very young (20-30) at 13.3%. Although teachers' age was not a study variable, the results implied that majority of teachers in Kasarani Sub-County were mature enough to handle or care for preschool children including teaching mathematic concepts.

4.1.4 Preschool Teacher Academic Level

Preschool teachers were a certificate, diploma or degree in early childhood education. The results are presented in figure 4.1.

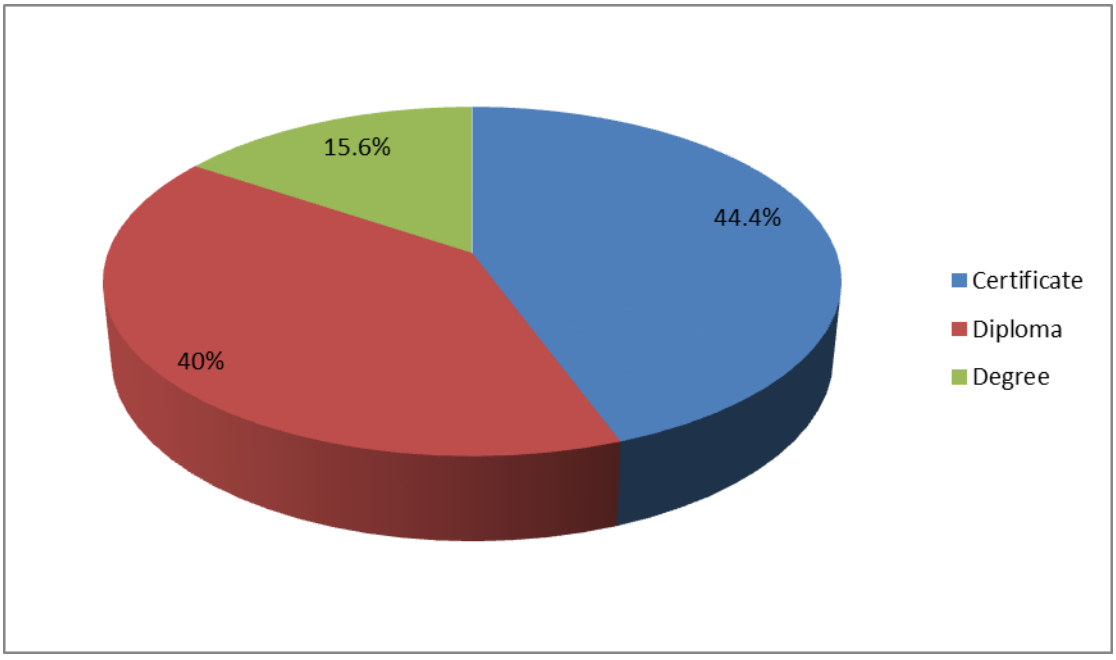


Figure 4.1 Proportions of teachers by Level of Training

Preschool teachers with certificate level of training in ECDE were 44.4%. Figure 4.2 also indicates that teachers with diploma level of training in ECDE were 40%. The

figure further indicates that preschool teachers with degree level of training in ECDE were 15.6%. These findings indicate that preschool teachers in Kasarani Sub-county were adequately trained in early childhood education including music and movement and its relevance in teaching and learning at the preschool level.

4.1.5 Preschool Teachers' Teaching Experience

Preschool teachers were asked to identify the class interval that best described their overall teaching experience in terms of number of years. The results are presented in figure 4.2.

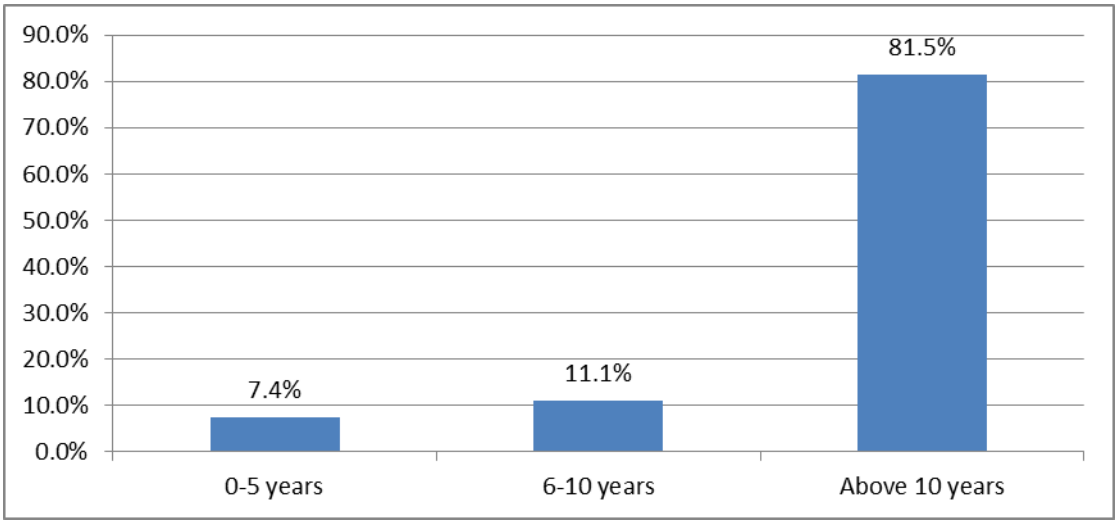


Figure 4.2. Preschool Teachers' Overall Teaching Experience in Years

The data presented in figure 4.3, indicates that majority of preschool teachers had a teaching experinece of more that 10 years. These results indicate that preschool teachers in Kasarani Sub-County had vast experience in preschool education and knowledgeable about the curriculum and specifically role of music in instructions.

These current study findings are inline with study results by Murundu, Chisikwa, Indoshi, Okwara and Otieno (2012), who conducted a study on preschool teacher-based factors influencing the implementation of Early Childhood Development and Education (ECDE) curriculum in Gem District and reported that more than 70% of the respondents had teaching experience of more than 5 years. The findings are also supported by Gillian (2010), in his study on challenges faced in the provision of quality of early childhood education in Kitui District. He revealed that more than 50% of the preschool teacher who participated in the study had a teaching experience of over 5 years which made them more competent in handling preschool learners and teaching/learning activities.

Further support to the current study findings is extended by Mudaki (2011), who asserted that more than 80% of the preschool teachers had worked for two years or more and were deemed adequately experienced in teaching preschool curriculum areas. Therefore, rich teaching experience is a key indicator of teachers' capability to use music as a medium of teaching mathematics.

4.2. Preschool Teachers' Use of Music to Teach Mathematics

In order to establish how preschool teachers' factors influenced the use of music to teach mathematics, it was essential to establish to what extent they used the medium to develop preschool children's understanding of mathematic concepts. The results are presented in Table 4.4.

Table 4.4 Preschool Teachers' Use of Music to Teach Mathematics

Indicators (Extent of)	Very Great Extent		Great Extent		Little Extent		Not at all	
	F	%	F	%	F	%	F	%
Integrating music with curriculum areas	23	51.1	10	22.2	7	15.6	5	11.1
Use music to make mathematics interesting	27	60.0	13	28.9	5	11.1	0	0.0
Use music to improve children's understanding when teaching	25	55.5	9	20	8	17.8	3	6.7
Use music to ensure mathematic activities run smoothly	23	51.1	12	26.7	7	15.6	3	6.7
Use music to teach mathematics concepts	31	68.9	10	22.2	4	8.9	0	0.0
MEAN SCORE	**26**	**57.8**	**11**	**24.4**	**6**	**13.3**	**2**	**4.4**

Table 4.4 shows the computed mean score of primary teachers' use of music, which indicated that majority (57.8%) of preschool teachers reported very great extent of use of music during mathematic instruction. Another 24.4% indicated great extent of use of music during mathematic instruction. The remaining respondents reported little extent (13.3%) and no use at all (4.4%) respectively.

More specifically, use of music to teach mathematic concepts was rated highly(68.9%), followed by use of music to make mathematics interesting (60.0%), then use of music to improve understanding (55.5%) and lastly use of music to ensure math activities run smoothly (51.1%). These findings mean that majority of preschool teachers in Kasarani Sub-County utilised music as a medium of teaching mathematics. The opinions of primary school head teachers, who are the immediate supervisors of

preschool teachers, were sought to corroborate preschool teachers' use of music during mathematic instructions. The results are presented in Table 4.5.

Table 4.5 Head teachers' Perceptions of Preschool Teachers' Use of Music to Teach Mathematics.

Items	N	Min	Max	Mean	Std Dev
Awareness that preschool teachers use music to teach mathematics	15	3	4	3.97	0.644
Preschool teachers use music to teach all the subject areas.	15	1	4	3.53	0.837
The school supports preschool teachers by buying nursery rhymes materials	15	2	4	3.81	0.713
The school supports preschool teachers by encouraging use of diverse ethnic music.	15	3	4	3.83	0.701
Teaching schemes and lesson plans show use of specific songs to teach mathematics.	15	2	4	3.94	0.652
Overall Mean				**3.82**	**0.709**

The results presented in Table 4.5denotes that the mean of each item was above 3.5 and the overall mean for head teachers' perception of preschool teachers' use of music to teach mathematics was 3.82 with a standard deviation of 0.709. Specifically, head teachers rated "Awareness that preschool teachers use music to teach mathematics and Teaching schemes and lesson plans show use of specific songs to teach mathematics" highest at means of 3.97 and 3.94 respectively. Table 4.5 also shows that head teachers supported preschool educators' use of music to teach mathematics by buying nursery rhyme books (M=3.81) and encouraging use songs from a variety of ethnic groups (M=3.83), specifically, where school language policy dictates otherwise. These

results mean that head teachers were aware and acknowledged that preschool teachers were using music during mathematic instructions.

To confirm whether preschool teachers were using music during maths instruction, a math lesson observation schedule was designed and used to observe educators during actual teaching. The results of observations are presented in Table 4.6.

Table 4.6 Observation of Preschool Teachers Use of Music during Mathematics Lesson

Observable Indicators of Teacher's Music Use During Mathematics Instruction/Lesson	**Agree**		**Disagree**	
	F	**%**	**F**	**%**
During mathematics lesson introduction	38	84.4	7	15.6
During mathematics lesson development	14	31.1	31	68.9
During mathematics lesson conclusion	35	77.8	10	22.2
Children are familiar with the song being used	41	91.1	4	8.9
Teacher sings together with children	23	51.1	22	48.9
Teacher uses music to teach mathematical concepts	31	68.9	14	31.1
Song(s) relevant to the mathematical concept being taught	27	60	18	40
Music instruments used to accompany the music	7	15.6	38	84.4
Variety of songs used in a single lesson	13	28.9	32	71.1
Use music to maintain children's attention	26	57.8	19	42.2
Use music to make learning mathematics interesting	34	75.6	11	24.4
Children excited about the use of music during mathematics lesson	42	93.3	3	6.7
Lesson plan shows evidence of teacher planning to use music during mathematics lessons	39	86.7	6	13.3
Overall Mean	**28.5**	**63.3**	**16.5**	**36.7**

The findings presented in Table 4.6 show that the overall mean for observations made on teachers' use of music during instructions was 63.3%, recording an average of 36.7 %of situations that teachers failed to use music. These findings mean that teachers in Kasarani Sub-County were using music to teach mathematics during actual instructions.

From the results in Table 4.6, it can be established that majority of teachers only used music to introduce (84.4%) and conclude (77.8%) a math lesson but did not use music during lesson development (31.1%). These findings imply that majority of teachers used music as a procedural component during mathematics lessons but not as a direct medium of teaching the subject. However, it is worth noting that most of the songs used (60%) were relevant to the mathematic concepts being taught.

Another common trend that can be observed from Table 4.6 is that most children (91.1%) were familiar with the song used and an unrivalled number of children (93.3%) were excited about the use of music during mathematics lessons. Lastly, a high number (86.7%) of teachers' lesson plans showed that they had planned to use music to teach mathematics. Noticeably, majority of preschool teachers had music indicated as, "Introduce with a relevant song" on their lesson plans. This explains why more than 80% of preschool teachers used music during lesson introduction as compared to anywhere else in the course of mathematics lesson.

The current study findings correspond with Wanyama (2012), who established that preschool teachers generally integrated music and movement activities with other

curriculum areas during instructions. A similar perspective was expressed by Nyageri (2014), who reported that preschool teachers in Trans Nzoia County were using music to teach different concepts and subject areas in the preschools.

4.3 Factors Influencing Teachers' Use of Music in Teaching Mathematics in Preschool

The major task of this study was to establish preschool teachers' factors that influenced their use of music to teach mathematics. The findings are presented in order of the objectives of the study from section 4.3.1 to section 4.3.4. The inferential statistics concerning **Ho1** to **Ho4** have also been presented along with the descriptive results as per each respective objective.

4.3.1 Teachers' Academic Level and Frequency of Use of Music in Teaching Mathematics

The first specific objective of this study was to establish the influence of preschool teachers' academic qualification and their use of music in teaching mathematics. The study sought to establish whether there was a significant relationship between preschool teachers' academic qualification and frequency of use of music in teaching mathematics and the following null hypothesis was generated and tested.

> ***Ho1:*** *There is no significant relationship between teachers' academic level and the teachers' frequency of use of music in teaching mathematics at 0.05 level of significance.*

To test this hypothesis, Chi-Square test of association was used. The results are presented in Table 4.7.

Table 4.7 Chi-Square Correlation of the Association between Academic Qualification and Use of Music to Teach Mathematics

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	4.531[a]	2	.104
Likelihood Ratio	5.557	2	.062
Linear-by-Linear Association	3.077	1	.079
N of Valid Cases	45		

The results displayed in Table 4.7 indicate that the Chi-square test computation for the relationship between teachers' academic qualification and use of music to teach mathematics was 4.531 with a p-value of 0.104 level of significance (2-sided). These results imply that there is no significant relationship between preschool teachers' academic qualification and the use of music to teach mathematics ($p=0.104>p=0.005$).

The hypothesis that stated that; There is no significant relationship between teachers' academic level and the teachers' frequency of use of music in teaching mathematics at 0.05 level of significance was therefore accepted ($p>0.05$) and its alternate rejected. Therefore, the academic qualification of preschool teachers in Kasarani Sub-County did not influence their use music to teach mathematics.

These results concur with Waigera (2013), who found no significant relationship between teachers' academic qualification and use of culturally relevant instructional materials. However, the results of this study disagree with a study conducted in USA by Barnett (2003), who found that teachers' academic qualifications have a positive relationship with effective curriculum implementation in American schools. Similarly, Gumo (2003), revealed that there was an important positive relationship between the teacher's academic qualification and their quality scores in teaching Art and Craft activities.

4.3.2 Teachers' Training and Use of Music in Teaching Mathematics

The second objective of the study was to determine the influence of teachers' level of training and their use of music in teaching mathematics. Teachers were asked to indicate if they were "trained" or "Not trained" on how use of music during instructions. The results obtained are presented in table Table 4.8.

Table 4.8 Teachers Level of Training in Use of Music to Teach Mathematics

Indicators	N	Min	Max	Mean	StdDev
Trained on how to integrate music and other curriculum areas.	45	1	2	1.92	0.897
Trained on how to use music to make teaching/ learning interesting.	45	1	2	1.85	0.832
Trained on how to use music to improve children understanding.	45	1	2	1.68	0.789
Trained on how to use music to make learning activities run smoothly.	45	1	2	1.71	0.864
Trained on how to use music to teach mathematics activities.	45	1	2	1.97	0.943
Overall Mean	**45**	**2**	**2**	**1.826**	**0.865**

Table 4.8 illustrates per item mean for teachers' training in use of music during mathematic instruction were above 1.5 and the overall mean was 1.826 with a strong positive standard deviation (0.865). This means that teachers in Kasarani Sub-County are somewhat well trained in the use of music during instructions.

In particular, preschool teachers rated, "Trained on how to use music to teach mathematics activities" And "Trained on how to integrate music and other curriculum areas" highest with standard deviations of 0.943 and 0.897 respectively. Use music to make learning activities run smoothly and use music to make teaching interesting were also favourably rated at 0.864 and 0.832. Lastly, use music to improve children understanding was ranked last at 0.789. These findings are in agreement with a study conducted by Nyangeri (2014) who reported that preschool teachers in Tranzoia

County were adequately trained on how to integrate music with other learnig/teaching areas.

The study went further to establish whether there was a statistically significant relationship between preschool teachers' level of training and their use of music in teaching mathematics. The following hypothesis was generated and tested.

> ***Ho2:*** *There is no significant relationship between teachers' level of training and their use of music in teaching mathematics at 0.05 level of significance.*

In testing this null hypothesis, Chi-square test of the relationship was computed. The results are presented in Table 4.9.

Table 4.9 Chi-Square Correlation of the Association between Preschool Teachers' level of Training and Use of Music to Teach Mathematics

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	14.557[a]	4	.006*
Likelihood Ratio	20.122	4	.000
Linear-by-Linear Association	5.805	1	.016
N of Valid Cases	45		

The findings in Table 4.9 indicate that the chi-square test results for the association between preschool teachers' level of training and use of music to teach mathematics was 14.557 with a p-value of 0.006 level of significance (2-sided). These Chi-square

statisctics mean that there is a significant relationship between preschool teachers' level of training and the use of music to teach mathematics ($p=0.006<p=0.05$).

The generated hypothesis that stated that; There is no significant relationship between teachers' level of training and their use of music in teaching mathematics at 0.05 level of significance was therefore rejected and it's alternate adopted ($p<0.05$). These findings imply that trained teachers are more effective in use of music to teach mathematics.

These results find support in the work of Mwololo, Koech, Begi and Mutweleli (2012), on preschool teachers' knowledge and attitudes towards use of visual media, which confirmed that trained preschool teachers frequently used visual media than the untrained teachers. The study also concurs with Aila (2005), who noted that trained teachers used instructional visual aids more often in comparison to other candre of teachers.

The current study findings are also echoed by Ng'asike (2004) who comfirmed that teacher training levels have positive influence on teachers' tendencies in using child centered teaching approaches. Kinuthia (2009), further concurs that training enhances teachers' favourable attitudes towards subject areas, raises activity level and also influences the quality of services delivered.

However, the current findings are inconsistent with Waigera (2013), who reported that there was no significant difference between teachers' level of training and use of culturally relevant instructional materials in preschool schools.

4.3.3 Teachers' Experience and Use of Music in Teaching Mathematics

The third objective of this study was to find out the influence of teachers' level of work experience on their use of music in teaching mathematics. The study sought to establish whether there was a statistically significant relationship between preschool teachers' teaching experience and their use of music in teaching mathematics. The following hypothesis was formulated and tested.

> ***Ho3:*** *There is no significant relationship between teachers' teaching experience and their use of music in teaching mathematics at 0.05 level of significance.*

Chi-square test of association was used to test this hypothesis. The results are presented in Table 4.10.

Table 4.10 Chi-Square Correlation of the Association between Preschool Teachers' Teaching Experience and Use of Music to Teach Mathematics

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	6.326[a]	4	.176
Likelihood Ratio	9.343	4	.053
Linear-by-Linear Association	4.239	1	.040
N of Valid Cases	45		

The findings presented in Table 4.10 indicate that the Chi-square test computation for the association between preschool teachers' teaching experience and use of music to teach mathematics was 6.326 with a p-value of 0.176 level of significance (2-sided). These Chi-square test results mean that there is no significant relationship between preschool teachers' teaching experience and the use of music to teach mathematics ($p=0.176>p=0.05$).

The formulated hypothesis that stated: There is no significant relationship between teaching experience and teachers' use of music in teaching mathematics at 0.05 level of significance was therefore accepted and its alternate rejected ($p>0.05$). These findings imply that a teacher's experience or lack of it does not influence his/her ability to use music during mathematics instruction activities.

Findings of the current study are in agreement with a study by Rotumoi (2012) who reported that although majority of teachers in his study had teaching experience of over 5years; they were not using instructional materials adequately in the classroom

during teaching and learning activities. Similarly, Waigera (2013) did a study on preschool teachers' application of materials that appeal to the culture of the child during instructions in Nyeri County. The results revealed that the relationship between use of culturally relevant instructional materials and teaching experience was not significant.

On the contrary, the current study finding contradicts the study done by Ngure 2014 which postulated that the skills accumulated by teachers with the years of exposure to instructional materials equipped them to produce and utilize instructional media and that teachers' teaching experience influenced the way they used materials in teaching the learners. In further disagreement with the current findings, Onasanya (2006) in a study on preschool teacher's choice, improvisation and usage of relevant teaching-aids for effective learning and teaching in Nigeria, established that the skills amassed by preschool teachers with years of exposure to teacher-made materials equipped them to produce and utilize instructional media effectively during actual lesson development.

4.3.3 Teachers' Attitude and Use of Music in Teaching Mathematics

The last task for this study was to establish the relationship between teachers' attitude towards use of music and their frequency of use of music in teaching mathematics. Teachers were asked to rate themselves on a four-points Likert scale to find the extent to which they were positive about the use of music in teaching mathematics. In the scale (4) denoted "Very Positive" while (1) demoted "Not Positive at All". The results are presented in Table 4.11.

Table 4.11 Preschool Teachers' Attitude towards Use of Music to Teach Mathematics

Indicators	N	Min	Max	Mean	StdDev
Use of Music is important in teaching mathematics	45	2	4	3.54	0.838
Use of music makes learning of mathematics easier	45	2	4	3.71	0.659
Use of music makes mathematics teaching interesting	45	1	4	3.29	0.937
Use of music in teaching mathematics is not boring	45	2	4	3.56	0.698
Use of Music when teaching mathematics is enjoyable	45	1	4	3.64	0.678
Music use in teaching mathematics is not intimidating	45	1	4	3.36	0.676
I feel comfortable using music as an instructional resource.	45	2	4	3.43	0.836
I feel joyous using music as an instructional resource.	45	1	4	3.39	0.685
When using music as an instructional resource in mathematics, I feel relaxed	45	2	4	3.32	0.945
When using music as an instructional resource in mathematics, I don't feel bored.	45	2	4	3.46	0.838
Overall Mean				**3.39**	**0.676**

The results presented in Table 4.11 indicate that the mean per item was above 3 for all test items. The Table also show that the overall mean for teacher attitude towards use of music to teach mathematics was 3.39 with a standard deviation of 0.676. In particular, preschool teachers rated "Use of music makes learning of mathematics easier" highly (Mean=3.71) while "When using music as an instructional resource in mathematics, I feel relaxed" was rated the lowest (Mean=3.32). These findings indicate that preschool teachers in Kasarani Sub-County had positive attitude towards use of music to teach mathematics.

The current study findings concur with Wanyama (2012) who did a study on prevailing attitudes and challenges in the effective implementation of early childhood music and movement curriculum in Eldoret Municipality, Kenya. He established that teachers generally had a positive attitude towards music and movement activities and its integration with other curriculum areas.

The study also felt it was necessary to establish whether there was a statistically significant relationship between preschool teachers' attitude and their use of music in teaching mathematics. The following hypothesis was formulated and tested.

> ***Ho4:*** *There is no significant relationship between preschool teachers' attitude and their use of music in teaching mathematics at 0.05 level of significance.*

Chi-square test of association was used to test this hypothesis. The results are displayed in Table 4.12.

Table 4.12 Chi-Square Correlation of the Association between Preschool Teachers' Attitudes and their Use of Music in Teaching Mathematics

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	11.332[a]	2	.003*****
Likelihood Ratio	11.396	2	.003
Linear-by-Linear Association	8.403	1	.004
N of Valid Cases	45		

The findings presented in Table 4.12, indicate that the chi-square test statistics for the relationship between preschool teachers' attitude and use of music to teach mathematics was 11.332 with a p-value of 0.003 level of significance (2-sided). These Chi-square test results mean that there is a significant relationship between preschool teachers' attitude and the use of music to teach mathematics ($p=0.003<p=0.05$).

The generated hypothesis that stated; There is no significant relationship between preschool teachers' attitude and their use of music in teaching mathematics at 0.05 level of significance was therefore rejected and it's alternate adopted ($p<0.05$). These findings imply that a teacher's attitude towards music and movement highly influence his/her likelihood to use music during mathematics instruction activities.

Findings of the current study are consistent with Mwololo (2009), who found a significant relationship between preschool teachers' attitudes towards instructional visual media and use of visual media during actual instructions. The findings are also in agreement with a study by Begi (2007), who reported that there was a significant relationship between attitudes towards computers and use of computers in instruction among preschool and lower primary school teachers in Nairobi province.

Further, consistencies between the current findings are rooted in the work of Nielsen (2011), who did a study on elementary British curriculum teachers attitude towards technology-assisted assessment tools. The mean scores from a series of belief statements suggested teachers' attitudes towards assessment practices and technology was positive. Similar results were also reported by Makobi (1985), whose study on

factors affecting music instruction in primary schools in Kenya reported that negative attitude towards music hindered music education in primary schools.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1. Introduction

This chapter presents the summary of findings and conclusions generated from the study results. Appropriate recommendations for stakeholders and suggestions for further research in areas that need improvement have also been presented. The study envisioned to assess whether preschool teachers in Kasarani Sub-County were using music to teach mathematics.

5.2. Summary of Findings

The study results show that majority of teachers were using music to teach mathematic concepts. The results also indicated that more than 15% of teachers were not using music to teach mathematic concepts.

The study established that majority of head teachers were aware that preschool teachers were using music to teach mathematics and other curriculum activities. They also acknowledged that preschool teachers scheme of work and lesson plans which they assessed (rubber stamped) on a regular basis showed evidence of preschool teachers using music to teach mathematics.

Actual classroom observation during mathematic lesson further confirmed that more than 63% of preschool teachers used music during mathematics lessons. However, more than 84% of the preschool teachers used music in the introduction to the mathematic lesson and not in the actual teaching of the lesson planned concept.

Summary of the findings based on each study objective and in descending order of significance:

5.2.1 Teachers' Academic Qualification and Use of Music in Teaching Mathematics

The findings under this objective was more than 95% of the preschool teachers had adequate academic qualifications to enable them use music to teach mathematics. However, the association between preschool teachers' academic qualifications and use of music to teach mathematics was not significant.

5.2.2 Teachers' Level of Training and Their Use of Music in Teaching Mathematics

The findings under this objective were first, the mean score of more than 1.8 on a two-point Likert scale was recorded. It showed that majority of teachers reported that they were trained in use of music to teach mathematics.Secondly, there was a significant relationship between preschool teachers' level of training and the use of music to teach mathematics.

5.2.3 Teachers' Level of Work Experience on Their Use of Music in Teaching Mathematics

With respect to the influence of teachers' level of work experience on their use of music in teaching mathematics, the findings under this study were first, approximately 88% of teachers had been teaching mathematics using music for more than 5 years.

However, the relationship between teachers' teaching experience and their use of music in teaching mathematics was not significant.

5.2.4 Teachers' Attitude towards Use of Music and Their Frequency of Use of Music in Teaching Mathematics

Lastly, concerning the relationship between teachers' attitude towards use of music and their frequency of use of music in teaching mathematics, the overall mean was above 3 on a four-point Likert scale with a standard deviation of 0.676. The relationship between preschool teachers' attitude and their use of music in teaching mathematics was significant.

5.3. Conclusion

The study developed the following conclusion from the findings:

First, majority of teachers were using music to teach mathematics while head teachers predominantly reported that preschool teachers' schemes of work and lesson plans evidenced their planning to use music during instructions. Classroom math lesson observation confirmed that more than average numbers of preschool teachers were using music to teach mathematics. It is therefore logical to conclude that preschool teachers in Kasarani Sub-County were using music to teach mathematics.

Secondly, the study did not find any association between preschool teachers' academic qualifications and use of music to teach mathematics. Therefore, the decision to use music to teach mathematics was not influenced by teacher academic qualifications.

Thirdly, there was a significant association between preschool teachers' training and their use of music to teach mathematics. It can therefore be concluded that a trained preschool teacher is more likely to use music to teach mathematics than an untrained preschool teacher when all other factors are kept constant.

Fourthly, most of the preschool teachers had been teaching mathematics using music for more than 5 years, but the statistical association between teachers' teaching experience and their use of music in teaching mathematics was not significant. It is reasonable to conclude that a teacher's experience does not influence his or her use of music to teach mathematics. Therefore, both experienced and inexperienced teachers in Kasarani Sub-County used music to teach mathematics to an identical extent.

Finally, it was evident that preschool teachers' attitude towards use of music to teach mathematics in Kasarani Sub-County was positive. The statistical association between preschool teachers' attitude towards use of music to teach mathematics and actual application of music in teaching mathematical concepts was significant.

5.4. Recommendations of the Study

From the study findings and resultant conclusions, the study made the following recommendation for practitioners and for further research:

5.4.1. Recommendation for Kenya Institute of Curriculum Development (KICD)

The KICD should come up with modules on step by step guidelines on how teachers should integrate music during teaching of mathematic concepts. The existing

curriculum content gives teachers the idea that music is a lesson introduction and conclusion tool but not an instruction medium. The modules should emphasise on how to use music during lesson development to arouse, nurture and deepen preschool children mathematic concepts.

5.4.2. Recommendation for Ministry of Education Science and Technology

The ministry should increase adequate teaching resources for use of music in teaching mathematics. This can be done by ensuring they give more financial support in schools. Secondly the ministry for education for science and technology should enforce the provision and guidelines on how teachers should integrate music during teaching mathematics. Lastly, the ministry of Education Science and Technology should conduct regular audit and inspections in pre-primary schools to ensure conformity to the guidelines.

5.4.3 Recommendation for Headteachers

Findings from the study had shown that most of the schools did not use music in teaching mathematics. To improve mathematics in school it is recommended that schools should provide a conducive learning environment that nurture preschool teachers' capacity to use music in teaching mathematics.

5.4.4 Preschool Teachers

Teachers should make an effort to develop a repertoire of music relevant to teaching of mathematics concepts. The repertoire should further be thematised with respect to the mathematic concepts being taught in the preschool syllabus. This will create a

collection of readily available and predetermined music for teaching all possible mathematical concepts at preschool level. Teachers should also improve their collection of music instruments and acknowledge their use in making music application in teaching mathematics more appealing to children.

5.5. Recommendations for Further Research

As far as recommendations to future researchers are concerned, the study came up with the following suggestions:

i) The current study focused on use music to teach mathematics, it would be very interesting if a study on the influence of music on mathematic achievement was conducted.

ii) Further, the current study was conducted in Nairobi County and as such it's results can only be applied to similar environments. Therefore, there is need for a national cross-sectional investigation to establish use of music in teaching mathematic concepts in Kenya.

iii) The current study was mainly conducted in public schools in Kasarani Sub-county and it would be useful for further research to be conducted with a focus on private schools to find out how similar or dissimilar the findings might be.

iv) This study investigated influence of teachers' academic qualifications, level of training, teachers teaching experience and attitudes towards use of music in teaching mathematics. Many other factors could influence integration of music in teaching mathematics, therefore more exploratory studies may be conducted

to establish other factors that might influence the use of music as a medium of teaching mathematics in preschool schools.

REFERENCES

Aila, H. P (2005). *Factors influencing the use of visual aids in preschools in Asego Division Homabay district*. Unpublished Med Thesis. Kenyatta University, Nairobi.

An, S. A., Kulm, G. O., & Ma, T. (2008). The effects of a music composition activity on Chinese students' attitudes and beliefs towards mathematics: An exploratory study. *Journal of Mathematics Education*, 1(1), 91-108

An, S., Ma, T., & Capraro, M. M. (2011). Preservice teachers' beliefs and attitude about teaching and learning mathematics through music: An exploratory study. *School Science and Mathematics Journal*, 111, 235-247.

Ankers, A., L., Lamas, J., & Tonyoy. C. (2005). Impact of Per Service Teaching Experience on urban school Teacher, *Journal of instructional psychology*, 32(1),82-98

Arnett S. E., & Freeburg. (2008). Family and consumer sciences Pre-service Teachers: Impact of an Early Field Experience, *Journal of family and consumer sciences Education,* 26(1), 48-56

Ary, D., Jacobs, L. C., & Razavieh, A. (2002) *Introduction to research in education* (6th ed.) Belmont, CA: Wadsworth/Thomson Learning.

Aunola, K., Leskinen, E., Lerkkanen, M. K., &Nurmi, J. E.(2004).Developmental dynamics of math performance from preschool to grade 2.*Journal of Educational Psychology*,96(4), 699−713.

Ayoo, S. J. (2002). An investigation of the Factors Influencing K.C.S.E Performance in Kisumu district.(Unpublished MEd Thesis).University of Nairobi.

Ayot, H. O. (1984). *Language for learning.* Nairobi: Macmillan publishers.

Bandera, A. (1982). Self-Efficacy Mechanism in Human Agency. *American Psychologist*, 37, 122 –147.

Bandura A. (1977). *Social learning theory*. Englewood Cliffs, Nj: Prentice Hall.

Bandura, A. (1986). Social foundations of thought and action: A social cognitive theory. Englewood Cliffs, NJ: Prentice-Hall.

Bariseri, N. (2000). *Primary music teacher education in England and Turkey*, unpublished PhD thesis, University of Durham.

Barnett, W. S. (2003). *Better teacher, better preschool*: Student achievement

Barnett, W. S. (2004). *Better teacher, better preschool*: Student achievement

Begi, N. (2007). A comparative study of preschool and lower primary school teachers' computer technology usage in teaching in Nairobi, Kenya, PhD. (Unpublished)

Benes-Lafferty, K. M. (1995). *An analysis of using musical activities in a second-grade mathematics class*.(Unpublished doctoral dissertation), Indiana University of Pennsylvania.

Birge, E. B. (1988). *History of public school music in the United States.* Reston, VA: Music Educators National Conference.

Bobis, J., & Bobis, E. (2005).*The empty number line: Making children's thinking visible. 20th Biennial Conference of the Australian Association of Mathematics Teachers: Making Mathematics Vital.* Sydney: Australia

Bolduc, J. (2009). Effects of a Music Programme on Kindergartners' Phonological Awareness Skills, *International Journal of Music Education*, 27(1), 37-47.

Bowman, B., Donovan, S., & Burns, S. (2001) *Eager to learn education ours ECDE teachers.* Washington, DC: National academy press.

Brewer, C. (1995). Music and learning: Seven ways to use music in the classroom. Tequesta, Florida

Brown, R. N. (2001-2003). *Why Music? Use Music to Teach! Intelli-tunes*. Retrieved July 16, 2008

Burack, J. 2005. "Uniting Mind and Music: Shaw's Vision Continues." *American Music Teacher* 55 (1) 84–87.

Campbell, P.S. (1998). *Song in their heads: Music and its meaning in children's lives*. New York: Oxford University

Clements, D. H., & Sarama, J. (2007). Effects of a preschool mathematics curriculum: Summative research on the Building Blocks project. *Journal for Research in Mathematics Education*, 38, 136−163.

Cohen, L. Manion, L., & Morrison, K. (2000). *Research methods in Education.* London: Routledge.

Colwell, C. M. (2008). Integration of music and core academic objectives in the K-12 curriculum: Perceptions of music and classroom teachers. *Update: Applications of Research in Music Education 26,* 33-41

Creswell, J. W. (2009*). Research design: Qualitative, quantitative, and mixed approaches* (3rd ed.) London: Sage Publication.

Cresswell J. W, Plano Clark VL.(2011). *Designing and conducting mixed method research.* (2nd Sage) Thousand Oaks, CA:

Digolo, B. A. (1997). *Availability and use of teaching and learning resources for music education in Kenya: A Survey of secondary schools in Nairobi Province, Kenya. M.* (Ed) thesis Kenyatta University

Dodge, D.T., & Heroman, C. (1999). Building Your Baby's Brain: A parent's guide to the first five years. Washington, D.C.

Duncan, G., Dorset, C., Classens, A., Magnuson, K., Huston, A., Klebanov, P., Pagani, L., Feinstein, L., Engel, Brooks-Gunn, J., Sexton, H., Duckworth, K., &Japel, C. (2007). School Readiness and Later Achievement. *Developmental Psychology*, 43, 1428-1446

Eshiwani, G.S., (1984). *A study of women's access to higher learning in Kenya with special reference to mathematics and science education.* Bureau of educational research, Kenyatta University College, Nairobi, Kenya.

Fortin, J. (2013). Integrating Music into Samoan Primary Schools: Teachers' Perceptions and Potential Benefits, *Independent Study Project (ISP) Collection*, 1713.

Fishbein, M & Ajzen, I. (2010) *Predicting and changing Behavior*: The Reasoned Action Approach. Pychology Press (Tylor & Francis)New York.

Gardner, H. (1983). *Frames of Mind.* New York: Basic Book Inc.

Garland, T., & Kahn, C. (1995). *Math and music: Harmonious connections*. Palo Alto: Dale Seymour Publications.

Gay L. R. (1981) *Educational research competencies for analysis and application*. Colombus Toronto & London: Charles E. Mairill Publishing Company.

Genalo, L. J., & Ogren, C. E.(2005)."K12 Engineering Education Field Experience". *Materials Science and Engineering Conference Papers, Posters and Presentations.* Paper 27.

Gillespie, C. W., & Glider, K. R. (2010).“Preschool teachers’ use of music to scaffold children’s learning and behaviour.”*Early Child Development and Care*180 (6), 799–808.

Gray, T. E. (2000). The relationship between the undergraduate music methods class curriculum and the use of music in the classrooms of in-service elementary teachers (Doctoral dissertation, Ball State University, 2000).*Dissertation Abstracts International, 61*(02), 418-A.

Greenes, C., Ginsburg, H. P., & Balfanz, R. (2004).Big Math for Little Kids. *Early Childhood Research Quarterly*, 19(1), 159-166.

Gumo, A. W. M. (2003). *Teachers" Factors related to the teaching of art and craft In pre- Schools in Kaloleni and Kikambala Division in Kilifi District*. (Unpublished Masters Thesis).Kenyatta University.

Handal, B., Bobis, J., & Grimison, L. (2001).*Teachers' mathematical beliefs and practices in teaching and learning thematically. In J. Bobis, B. Perry, & M. Mitchelmore (Eds.), Numeracy and beyond. Proceedings of the twenty-fourth annual conference of the mathematics education research group of Australasia* (pp. 265–272), Sydney: MERGA.

Hanshumaker, J. (1980). The Effects of Arts Education on Intellectual and Social Development. A Review of Selected Research, *Bulletin of the Council for Research in Music Education*, 61, 10-28.

Harkleroad, L. (2006). *The math behind the music.* Cambridge, UK: University Press.

Hash, M. P. (2009). Preservice Classroom Teachers' Attitudes Toward Music in the Elementary Curriculum. *Journal of Music Teacher Education,* 19 (2) 6-24.

Hausfather, S. J. (1996). Vygotsky and schooling: *Creating a social context for learning. Action in Teacher Education,* 18(2), 1-10.

Hendrick, J. (1998). Total Learning, Developmental Curriculum for the Young Child (5th Ed.) Columbus, OH: Merrill

Holland, S. (2011). Whole body interaction in abstract domains. In: England, David ed. *Whole Body Interaction.* Human-Computer Interaction Series. London, U.K.: Springer Verlag, pp. 19–34.

Hurdson, N. J. (2011). Musical Beauty and Information Compression: Complex to the Ear but Simple to the Mind? *BMC Research Notes,* (4)9

James, A .R. (2000).*When I listen to music Young Children*, (55) 3, 36- 37.

Jensen, H. J. (2002) Mathematics and painting: *Interdisciplinary Science Review*, (27) 1, 45-49.

Johnson, G. L. & Edelson, R. J. (2003).Integrating Music and Mathematics in the Elementary Classroom. *The National Council of Teachers of Mathematics, Inc.* 474 – 479

Kempe, A. L., & West, T. (2010).*Design for learning in music*. Stockholm: Norstedts.

KIE(1990b). *Kenya Preschool teachers' activities guide series book 1: Management and Language activities,* Nairobi: Kenya Literature Bureau.

Kothari, C. (1990*). Research Methodology. Methods and techniques* (2nd ed.). New Dehli: New age international publishing Inc.

Lee,Y. (2008). *Current music practices and teachers" needs for teaching music in public preschools of South Korea*. (PhD. Thesis), University of Missouri.

Lewis, R. and J. Aiken, (2000). Attitudes toward mathematics, *review of educational research*, 40(4): 551-596.

Makobi, T.S. (1985). Factors affecting music education in primary schools in Kenya. Nairobi. University of Nairobi.

Maltester, J. (1986). Music: *The social and academic edge,* 25 -27.

MERC Conference (2008): *Education : New horizons 4th July 2008 – Education building* Monash University: Clayton campus

Ministry of Education (2003). *Teacher education system overhaul (TESO) Handbook*. MOE, Addis Ababa, Ethiopia

Moyles, J., A. (2000). *Too busy to play: A framework for playful teaching*. Buckingham: open University press.

Moyles, J., A. & Adams (2000).A tale of the unexpected: Practitioners' expectations and children's play *in Journal of In-service Education* 26(2):349 369 https://www.researchgate.net/publication/233565226_A_tale_of_the_unexpected_Practitioners'_expectations_and_children's_play

Mudaki, Joy, B. (2011) Supervision of ECDE programmes. *Implication for the provision of quality Early Childhood Education in Nairobi province. Government printers, Nairobi*

Mugenda, O. and Mugenda, A. (2003).*Research Methods. Quantitative and Qualitative Approaches.* Nairobi: African Center for Technology Studies (ACTS) Press.

Mugo, W. J. (2009). *Effects of an inservice workshop for teachers on frequency of preschool children's Accidents (* Research Thesis.) Kenyatta University.

Muijs, D. (2004). *Doing Qualitative Research with SPSS*. London: SAGE Publication

Mutunga, P., & Breakel, J. (1992).*Mathematics Education*. Nairobi: ERAP

Muyoka, V. W. (2012). *An assessment of factors influencing the implementation of early childhood development and education policy in Bungoma County, Kenya*. Unpublished thesis, Moi University. Retrieved from;http://ir.mu.ac.ke:8080/xmlui/bitstream/handle/123456789/854/violet

Mwangi, M. W. (2000). Pre-School teachers 'use of oral instructional strategies in teaching in English: a study in Kasarani division, Nairobi province, Kenya. (Unpublished M.Ed. Thesis), Kenyatta University.

Mwangi, S. K. (2000). Availability and utilization of Resources for the Teaching of Music in selected primary teachers‟ Training colleges in Kenya. (Unpublished Med. Thesis), Kenyatta University.

Mwololo, J. N, Koech, G. B, Begi, N & Mutweleli, S. M. (2011). *Preschool teachers knowledge and attitudes towards use of visual media in instructional delivery in Kibwezi district Kenya*. Journal of research in education and society. Kenyatta University.

NACECE (2000). *Early childhood education*. Nairobi: East African educational publishers.

National Centre for Early Childhood Education (2000).*Toys and materials for play and learning*. Nairobi: East African National publishers.

Ng'asike, J. T. (2004). *Teacher's use of play as medium of bridging pre-school children's mathematical experiences: A study of Kasarani division, Nairobi, Kenya.*(Un Published M.Ed. Thesis), Kenyatta University.

Nielsen. L.D, (2011) A study of k-12 Music Educators' Attitudes towards Technology Assisted Assessment Tools. University of Nebraska-Lincoln, Idnies

Nyageri, E.J. (2014). Determinants of preschool teachers' use of music as a medium of instruction in Kitale municipality, Trans-Nzoia County, Kenya. Unpublished Med Thesis Kenyatta University.

Odongo, B. C. (2009). *Promoting child development through music: A comparison of preschool teachers, attitudes in* Kenya and United States.

Oduolowu, E. (2012). The effects of training on pre-school teachers practices in Oyo State, Nigeria. *International Journal of Learning & Department,* (2164 – 4063) 2012, 2-5

Office of Technology Assessment (1995).*Teachers and technology: making the connection*. Washington, D.C: Department of Education.

Olabode, O. T. (2012). *Effects of teachers' qualifications on the performance of senior secondary school physics students: implication on technology in Nigeria.* Department of Curriculum Studies, Ekiti State University, Ado-Ekiti, Nigeria

Pallesen, K. J., et al. (2010). *Cognitive control in auditory working memory is reference to mathematics and science education*. Bureau of educational research, Kenyatta University College, Nairobi, Kenya

Patton M.Q. (2002). *Qualitative research and evaluation methods*. (3rd Sage Publications) Thousand Oaks, CA:

Petress, K. (2005). *The Importance of music education,* 126 (1) 112-115.

Pietra, J, D. C., Santa Cruz, Bidner, S & Devaney, T. A. D. (2010). Pre service Elementary Classroom: Teachers' attitude toward music in the School Curriculum and Teaching Music.

Reif, N., & Grant, L. (2010). Culturally responsive classrooms through art integration. *Journal of Praxis in Multicultural Education,* 5 (1) 100-115.

Resnick, G & Zill, N. (2002) *Relationships of teacher beliefs and qualification to classroom quality in head start* (Paper presented at the head start National conference, Washington DC)

Rotumoi, J. (2012). *Factors influencing the choice of approaches used by preschool teachers in Baringo county, Kenya.*(Unpublished med thesis). Moi University, Kenya.

Shiundu, L. A. (2000). *Practice in music and movement: A study of music teaching in selected pre-schools in Nairobi Province*. (Unpublished Med. Thesis), Kenyatta University

Sidhu, K. S. (1982). *The teaching of mathematics*. New Delhi. Sterling publisher

Thika District Education Board (2009).Task force report on causes of poor KCPE academic performance in Thika district and municipality,8(13), 927-937

Uwezo (2012) National assessment of Kenyan children numeracy and literacy from Http://www.uwezo.net

Vannatta-Hall, J. E. (2010). *Music education in early childhood teacher education: The impact of a music methods course on pre- service teachers" perceived confidence and competence to teach music*. PhD Thesis university of Illinois at Urbana – Champaign.

Waigera, J. (2013). *Preschool teachers' use of culturally relevant instructional materials in teaching in Kieni West district, Nyeri County*. Unpublished thesis, Kenyatta University.

Wanyama, M., Sinyei, C.J.M (2012) Dealing with the prevailing attitudes and challenges for effective implementation of early childhood music and movement Curriculum in Eldoret Municipality, Kenya. *Research journal in organizational psychology & Educational studies* 1(5) 295-302

Watt, H. (2000). *The teaching of music in the primary school by the non-specialist, (Durham Theses)*, Durham University.

Whitecomb, R. (2012). "*The role of music in American preschools: Teacher's practices and altitudes." Paper presented at the annual meeting of the 92 ISME World Conference and Commission Seminars*, Thessaloniki Concert Hall, Thessaloniki, Greece, Jul 15, 2012.

Whitehead, B. J. (2001). *The effect of music intensive intervention on mathematics scores of middle and high school students*. (Unpublished doctoral dissertation), Capella University.

APPENDICES

APPENDIX I: INFORMED CONSENT

To the Preschool Teacher,

School_____.

Dear Sir/Madam,

RE: RESEARCH PARTICIPATION REQUEST

My name is Ruth Nyakinyi Macharia, a Masters student from Kenyatta University. I am conducting a study on preschool teachers' factors influencing their use of music as a medium of teaching mathematics in Kasarani Sub-county, Nairobi County, Kenya.

In order for me to come up with valuable recommendations for ECDE stakeholder, your humble participation is necessary. All responses will be kept confidential. I trust the findings will be of use to ECDE sector when the study is finalized. Please complete all the sections of the questionnaire as objectively as you can.

Your contribution will be highly appreciated.

Yours Faithfully,

Ruth Nyakinyi Macharia

Kenyatta University

APPENDIX II: QUESTIONNAIRE FOR PRESCHOOLTEACHERS

Please go through the questionnaire item-by-item and write your answers in the space provided (or do as required) or tick the correct box.

SECTION A: DEMOGRAPHIC INFORMATION

1. What is your gender? Male [ ] Female [ ]

   Age bracket

   20-30 [ ]

   30-40 [ ]

   40-50 [ ]

   50 and above [ ]

2. What is your highest academic level?

   K.C.P.E [ ]

   K.C.S.E [ ]

   ECDE Cert [ ]

   Diploma [ ]

   Bachelor's degree [ ]

3. For how many years have you been teaching preschool mathematics since teacher training?

   0 – 5 years [ ]

   6 - 10 years [ ]

   Above 10 years [ ]

SECTION B: USE OF MUSIC IN TEACHING MATHEMATICS

Please indicate (√) to what extent you use music during teaching of mathematic concepts.

		Very Great Extent	**Great Extent**	**Little Extent**	**Not at all**
i.	To what extent do you integrate music with curriculum areas?				
ii.	To what extent do you use music to make mathematics interesting?				
iii.	To what extent do you use music to improve children's understanding when teaching?				
iv.	To what extent do you use music to ensure mathematic activities run smoothly?				
v.	To what extent do you use music to teach mathematics concepts?				

SECTION C: PRESCHOOL TEACHERS' TRAINING IN THE USE OF MUSIC IN TEACHING MATHEMATICS

Please tick (√) the response that indicates the extent you agree or disagree with the following statements.

	Indicators	Trained	Not Trained
i.	I am trained on how to integrate music and other curriculum areas.		
ii.	I am trained on how to use music to make teaching/learning interesting.		
iii.	I am trained on how to use music to improve children understanding.		
iv.	I am trained on how to use music to keep learning activities run smoothly.		
v.	I am trained on how to use music to teach mathematics activities.		

SECTION D: PRESCHOOL TEACHERS' ATTITUDES TOWARD USE OF MUSIC IN TEACHING MATHEMATICS

Put a tick (√) for the best response in relation to how positive you are towards use of music in teaching mathematics.

		Very Positive	Positive	Less Positive	Not Positive at All
i.	Use of Music is important in teaching mathematics				
ii.	Use of music makes learning of mathematics easier				
iii.	Use of music makes mathematics teaching interesting				
iv.	Use of music in teaching mathematics is not boring				
v.	Use of Music when teaching mathematics is enjoyable				
vi.	I don't feel intimidated when I use music as a medium of instruction in teaching mathematics				
vii.	I feel comfortable using music as an instructional				

	resource.				
viii.	I feel joyous when I use music as a medium of education				
ix.	When using music as an instructional resource in mathematics, I feel relaxed				
x.	When using music as an instructional resource in mathematics, I don't feel bored.				

THANK YOU VERY MUCH FOR YOUR COOPERATION!

APPENDIX III: QUESTIONNAIRE FOR HEADTEACHERS

SECTION A: DEMOGRAPHIC INFORMATION

1. Preschool teachers' age bracket:
   20-30 years [ ] 31-40 years [ ] 41-50 years [ ] 51+ years [ ]

2. Preschool teacher's highest academic grade:
   K.C.S.E [ ] K.C.P.E [ ] University Degree [ ]

3. Preschool teacher's highest level of training:
   ECDE Certificate [ ] ECDE Diploma [ ] B/Ed in ECDE [ ]

4. Duration in years preschool teacher has since teacher training:
   0 – 5 years [ ] 6 - 10 years [ ] Above 10 years [ ]

SECTION B: PRESCHOOL TEACHERS' USE OF MUSIC TO TEACH MATHEMATICS

Please tick (√) the most appropriate response in relation to your opinion about use of music in teaching mathematics to preschool children by preschool teachers in your school.

Items	**Strongly Agree**	**Agree**	**Disagree**	**Strongly Disagree**
I am aware that preschool teachers use music to mathematics				
Preschool teachers use music to teach all the subject areas.				
The school supports preschool teachers by buying nursery rhymes.				
The school supports preschool teachers by encouraging use of diverse ethnic music.				
Teaching schemes and lesson plans show use of specific songs to teach mathematics.				

THANK YOU VERY MUCH FOR YOUR COOPERATION!

APPENDIX IV: MATHEMATIC LESSON OBSERVATION GUIDE

1. Teachers' gender. Male [ ] female [ ]

2. Preschool teachers' use of music in teaching mathematics

Observable Indicators of Music Use During Mathematic Instructions/Lesson	**Agree**	**Disagree**
Teacher uses music during mathematics lesson introduction		
Teacher uses music during mathematics lesson development		
Teacher uses music during mathematics lesson conclusion		
Children are familiar with the song being used		
Teacher sings together with children		
Teacher uses music to teach mathematical concepts		
Is the song(s) relevant to the mathematical concept being taught		
Are music instruments used to accompany the music		
Variety of songs used in a single lesson		
Teacher uses music to maintain children attention		
Teacher uses music to make learining mathematic interesting		
Children excited about the use of music during mathematic lesson		
Lesson plan show evidence of teacher planning to use music during teaching of methematic lessons		

APPENDIX V: AUTHORIZATION LETTER FROM NACOSTI

NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

Telephone:+254-20-2213471,
2241349,3310571,2219420
Fax:+254-20-318245,318249
Email: dg@nacosti.go.ke
Website : www.nacosti.go.ke
When replying please quote

NACOSTI, Upper Kabete
Off Waiyaki Way
P.O. Box 30623-00100
NAIROBI-KENYA

Ref: No. **NACOSTI/P/18/56043/27146**

Date: **5th December, 2018**

Ruth Nyakinyi Macharia
Kenyatta University
P.O. Box 43844-00100
NAIROBI.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on ***"Use of music as a medium of teaching mathematics in pre-primary in Kasarani, Nairobi City County, Kenya,"*** I am pleased to inform you that you have been authorized to undertake research in **Nairobi County** for the period ending **3rd December, 2019.**

You are advised to report to **the County Commissioner and the County Director of Education, Nairobi County** before embarking on the research project.

Kindly note that, as an applicant who has been licensed under the Science, Technology and Innovation Act, 2013 to conduct research in Kenya, you shall deposit **a copy** of the final research report to the Commission within **one year** of completion. The soft copy of the same should be submitted through the Online Research Information System.

Kalerwa

GODFREY P. KALERWA MSc., MBA, MKIM
FOR: DIRECTOR-GENERAL/CEO

Copy to:

The County Commissioner
Nairobi County.

The County Director of Education
Nairobi County.

APPENDIX VI: PERMIT LETTER FROM NACOSTI

THE SCIENCE, TECHNOLOGY AND INNOVATION ACT, 2013

The Grant of Research Licenses is guided by the Science, Technology and Innovation (Research Licensing) Regulations, 2014.

CONDITIONS

1. **The License is valid for the proposed research, location and specified period.**
2. **The License and any rights thereunder are non-transferable.**
3. **The Licensee shall inform the County Governor before commencement of the research.**
4. **Excavation, filming and collection of specimens are subject to further necessary clearance from relevant Government Agencies.**
5. **The License does not give authority to transfer research materials.**
6. **NACOSTI may monitor and evaluate the licensed research project.**
7. **The Licensee shall submit one hard copy and upload a soft copy of their final report within one year of completion of the research.**
8. **NACOSTI reserves the right to modify the conditions of the License including cancellation without prior notice.**

National Commission for Science, Technology and innovation
P.O. Box 30623 - 00100, Nairobi, Kenya
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REPUBLIC OF KENYA

National Commission for Science, Technology and Innovation

RESEARCH LICENSE

Serial No.A 22180

CONDITIONS: see back page

THIS IS TO CERTIFY THAT:
MS. RUTH NYAKINYI MACHARIA
of KENYATTA UNIVERSITY, 7194-200 NAIROBI,has been permitted to conduct research in *Nairobi County*

on the topic: *USE OF MUSIC AS A MEDIUM OF TEACHING MATHEMATICS IN PRE-PRIMARY IN KASARANI, NAIROBI CITY COUNTY, KENYA*

for the period ending:
3rd December,2019

Permit No : NACOSTI/P/18/56043/27146
Date Of Issue : 5th December,2018
Fee Recieved :Ksh 1000

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Applicant's Signature

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Director General
National Commission for Science, Technology & Innovation