HOME ACTIVITIES PROMOTING MATHEMATICAL SKILLS IN FOUNDATION PHASE: A CASE STUDY OF GRANDMOTHER-HEADED HOUSEHOLDS

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DECLARATION

I, the undersigned, Nolukholo Faith Hlungulu, hereby solemnly declare that the work contained in this thesis is entirely my own original work with the exception of such quotations or references which are distinctive of their own sources or authors. All the sketches and tables were produced by me with the exception of where I have acknowledged that they were taken from another source.

This dissertation has not been submitted and will not be presented at any other University for an equivalent or any other degree award.

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Signature of author and date

Nolukholo Faith Hlungulu

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Dedication

This thesis is dedicated to:

- The Mantile family from Port Elizabeth for your support and encouragement and seeing greatness in me.
- My primary school teacher Mrs Vuza (Matshezi) who believed in me even though there was nothing happening in my life.

ABSTRACT

Recent factors identified as contributory to poor mathematics performance in South Africa include lack of parental involvement coupled by the divorce of mathematics education to children's everyday lives. This exploratory study, therefore focused on home activities grandmothers engage their Grade 2 grandchildren that may promote mathematical skills of Foundation Phase learners. This study followed a qualitative, interpretive and case study research design, to explore home activities grandmothers engage their Grade 2 grandchildren that may promote mathematical skills of Foundation Phase learners. A small scale study of six grandmothers and three Grade 2 teachers were sampled through purposive and snowball sampling**.** In line with the protocol of the case study, semi-structured individual face to face interviews and shadowing were used to collect data. One striking feature of the main findings was the diversity mathematics applications home activities contained. These include physical, financial and fun playful home activities. Data also revealed that these home activities could reinforce numbers and what numbers mean; reinforce shape recognition and spatial relationships; complement matching, classification and sorting and reinforce measuring and time. This implies that curriculum must incorporate children's social capital. Both teachers and grandmothers acknowledged that children's mathematics education is complex and an effective partnership between grandmothers and teachers is needed if children are to be competent in mathematics.

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Chapter 1

Background of the study

1.1. Introduction

Many children in South African do not exhibit adequate mathematical skills. Education reformers in South Africa are concerned about mathematics education in South Africa because of the apparent inability of South African learners to compete successfully with their peers from other countries in global mathematics tests (Trends in International Mathematics and Science (TIMMS) ,2011; Southern and Eastern Africa Consortium for Monitoring Educational Quality Study (SACMEQII), 2006).This concern emanates from the reality that society requires mathematical knowledge in order to survive and prosper, and that South African society is far behind in attaining this knowledge. In the Eastern Cape (EC) where the study was conducted, mathematics performance for Grade 1, 2 and 3 stood at 64.5%, 57, 7% and 48.8% respectively (Department of Education, 2015). These findings revealed a decline of learner performance in mathematics as learners proceed to higher grades. Some of the main reasons attributed to this decline include the abstractness of mathematics; the divorce of mathematics in children's daily lives; and the lack of parental participation (Spaull, 2011; Feza, 2015).

In addition, curriculum prescripts have eroded family engagements and connections with schools has been compromised (Moloi, 2006). The curriculum prescripts seemed to reinforce institutional divorce by excluding from discussions the intellectual thought, scholarship and history, culture, contributions and experiences of minority group such as grandmother-headed households (Yaro, 2015). This resulted into teachers' lack of understanding of what grandmothers engage in with their grandchildren at home that can be incorporated in the teaching of mathematics. This lack of understanding acted as a catalyst for the divorce of mathematics, between mathematics at home and mathematics at school (Tatira, Mutambara, & Chagwiza, 2012). Through the omission of such understanding, schools had become monoculture environments (Christianakis, 2011). Monoculture can be defined as a practice of actively preserving a national culture via the exclusion of external

influences (ibid). This study supported the notion of pragmatism theory which conceives education as an outcome of social process. According to Singh (2007), social and cultural issues cannot be denied legitimacy in the philosophies of mathematics and must be acknowledged as playing an essential and constructive role in the natures of mathematical knowledge". Hence, this study attempted to investigate home activities grandmothers engage their grandchildren that may promote mathematical skills of Grade 2 Foundation phase learners.

1.2. Background of the study

Schools and families have been described as partners in the education of their children. Parental involvement and participation in education is now assuming a new form in South Africa as a result of the greater democratization of education (Department of Basic Education, 2003). Reports revealed that a majority of children do not stay with their biological parents, as a result, there is a significant number of learners that reside in households that are headed by grandparents; grandmothers in particular (Statistics South Africa, 2011; Plaatjies, 2013; Duku, 2006). Given that parents and other caregivers are an immediate part of the social context of a child, grandmothers are positioned as a prime source of engaging children in informal home activities and interactions with the potential to enhance children's mathematics learning. Makalima (2010) identified structural factors that give rise to grandmother-headed households. These included death of parents from HIV/AIDS, teenage pregnancy, alcohol and drug abuse, and migration labour. Regardless of these factors, extensive evidence showed that children inclusive family engagements or activities may potentially promote children's mathematical skills (Geetha, Ramani, & Siegler, 2014).

There is a wide spread agreement in international research of the beneficial role of home activities in the development of mathematical skills (Geetha, Ramani, & Siegler, 2014; Kleemans, Peeters, Seggers, & Verhoeven, 2012). These studies revealed that the participation of parents in their children's mathematics education and development at home is carried out in different ways. For instance, Goldman and Booker (2009) in Canada worked with six families (grandparents and other family members and their children between ages 7-8 years from diverse socio-

economic backgrounds. Findings showed how planning family events using a diary or a calendar can help children see the importance of time. Children were also encouraged to play with blocks, a popular activity found in most families, which contributes to the development children's mathematical skills such as enumeration, classification, spatial reasoning, knowledge of geometric shapes, numerical knowledge, and problem-solving skills (Ramani, Hirsch-Pasek, & Pan, 2014).

Similarly, in China, Ramani, Hirsch-Pasek, & Pan (2014) examined 7 and 8-year-old same-age, same-sex pairs of children from different families. Since many young children are fascinated by animals, Chinese families use animals as a theme to draw these young children into the field of mathematics. Mathematics activities using animals can not only build mathematical skills, but could also increase vocabulary and, build fine motor skills and improve reasoning. In the United Kingdom and Bangladesh studies of grandparents of children between 5-9-year-old from different ethnic backgrounds echoed the same sentiments when showing that mathematics knowledge can developed when engaging with their children through gardening and landscaping and house design (Eurydice, 2011; Geetha, Ramani, & Siegler, 2014). Landscaping and house design will often include elements of patterns. For example, many fences and or paved areas include a pattern arrangement. Children learnt to identify, describe, sort, measure, compare and understand conditions which expose children to number operations. Other studies showed that learners also experience mathematical skills in activities such as board and card games that involve counting, examining and working with patterns; number recognition, measurements and calculations in contexts such as cooking and carpentry (Eurydice, 2011).

In Sub-Saharan countries studies showed that the role of home activities is highly recognized and it is expected to increase even further. From these studies various home activities have been identified such as baking, shopping and budgeting, games, sewing have emerged as important activities used by several families in developing mathematical skills of young children (Brosnan & Hartong, 2011). During sewing and knitting, decreasing and increasing the number of stitches usually follows a pattern (Yaro, 2015).

In South Africa as well, family cultural aspects relating to plays and home activities were identified as catalyst that can be incorporated in the learning of mathematics in primary school (Tatira, Mutambara, & Chagwiza, 2012). These activities included home cultural games which involve reading and following instructions and making calculations, whilst household chores such as gardening, shopping, reading labels, cooking, planning events and using diary and calendar. Nkopodi and Mosinmenge (2009) studied mathematical concepts like symmetry, counting geometrical shapes and proportions that were identified in the indigenous game of *upuca*, *ugqaphu*, *uchwele*, *umlabalaba* amongst others.

The indigenous games above suggest that there may be a link between home activities, games, and young children's mathematics. Mathematical skills such as 'same' or 'different',' more' or 'less', 'left' or' right', naming shapes and dates, encouraging sorting, symmetry, sequencing, measuring and counting and introducing concepts related to subtraction and addition, may be promoted through these games (LeFevre, Skwarchuk, Smith-Chant, Fast, Kamawar & Bisanz, 2009; Chikodzi & Nyota, 2010). Furthermore, some home activities and games complement children's matching, classification and sorting skills. Moreover, participation in mathematical related activities at home encourages the language of mathematics and develops number vocabulary and reinforces measurement, patterns and geometrical shapes (Kleemans, et al., 2012).

Since language is an important factor in the learning of mathematics it is important for children to possess this skill too. The understanding of both the spoken and written words is made difficult by the complicated and ever changing interactions among phonological processing, syntax structure and semantic variation inherent in words used to convey the meaning (Morin & Franks, 2010). An emerging consensus is that it is important for teachers to have knowledge of the various ways in which language is used because of its important role in early learning experiences (Pal, 2009). The use of language must be kept simple. The problem lays in the fact that many children; especial those from poor backgrounds, as in this study, come to school with little knowledge of the language of learning (Howie, 2006). The disadvantaged children are more likely to perform poorly at school because of their "different home environments and practices of school mathematics that do not align

with knowledge, skills and dispositions that these children may bring to school" (Pal, 2009). Children who stem from disadvantaged groups are more at risk of not developing adequate mathematical skills because of their varied socio-cultural experiences and lack of "out of school" educational support (Pal, 2009).

1.3. Problem statement

Mathematics is an essential skill for everyday living and a prerequisite for most career choices. However, significant numbers of South Africans, across all age groups are at risk of not developing the mathematical skills needed to fully participate in the economy (Spaull, 2011). The recent factors that have been identified as contributory to poor mathematics is lack of parental involvement coupled by the divorce of mathematics education to children's everyday lives. This challenge has been exacerbated by the fact that mathematics education, in the school environment, seems to isolate family connections and learner social capital (Yaro, 2015). Mathematics curriculum also seem to exclude families by disregarding their culture, intellectual thought, history, experiences and everyday lives. Yet, approaches ought to be developed to help link school mathematics with children's everyday activities so as to help with mathematics concept-formation, in order to drive away the fear of the subject amongst learners and to create, grow and nurture the love of mathematics.

While grandmother-headed households have become prevalent in South Africa, schools are influenced by the traditional approaches that tend to consider families from disadvantaged backgrounds as deficient (Edward, 2006). These perceptions and misrepresentations may keep schools from seeing grandmothers for who they are and not making assumptions based on what they think they know about their learner's' cultures, family structures, and language (Al-Mahdi, 2009). These may create obstacles for grandmothers as they navigate the educational system and interacting with schools. Exploring home activities grandmothers engage in with their Grade 2 grandchildren may provide Foundation Phase teachers with insights of their learner's social capital that can be incorporated in the teaching and learning of mathematics. Hence, this study sought to explore home activities grandmothers

heading households engage their grandchildren in that can promote and instil mathematical skills of Grade 2 Foundation Phase learners.

1.4. Research question

The inquiry of this study is guided by the following:

1.4.1. Main research question

What home activities do grandmothers use that may promote mathematical skills of Grade 2 Foundation Phase learners?

1.4.2. Sub-research questions

- What are the grandmothers' perceptions of their role with regard to their grandchildren's mathematics education?
- How do home activities link with Grade 2 mathematics skills?
- How do grandmothers and Grade 2 teachers interact to promote Grade 2 learner's mathematical skills?

1.5. Objective of the study

- To explore grandmothers' perceptions of their role with regard to their grandchildren's mathematics education.

- To determine home activities grandmothers, engage their grandchildren that can promote Grade 2 mathematical skills.

- To highlight how do home activities link with Grade 2 mathematics skills?

- To determine the way in which grandmothers and Grade 2 teachers interact to promote Grade 2 leaner's mathematical skills.

1.6. Purpose of the study

The purpose of this study was to explore a range of home activities grandmothers engage their grandchildren that may be used to promote Grade 2 mathematical skills.

1.7. Motivation of the study

The researcher became interested in understanding the parenting systems that operate in a society and the impact thereof in terms of Foundation Phase learners' mathematics education. The patterns of parent attendance during consultation with educators suggested that many learners rely on alternative (support) systems of caregivers such as grandmothers. There appears to be a gradual increase or paradigm shift from the nuclear family as primary caregivers to the extended family. This may be due to many factors, such as, high divorce rate, HIV/AIDS related deaths, high mortality rate, financial constraints, incarceration and any other limitations and restraints which hinders biological parents from raising their children. Due to these factors, the nuclear family requires an intervention, which usually results in a grandparent(s)'s increased supportive role. The bulk of care for orphans, or affected children, within the extended family rests with grandmothers (Plaatjies, 2013).

1.8. Significance of the study

This study sought to reveal the contributions of grandmothers towards their grandchildren's mathematics education in urban, rural and township areas. The study further sought to add insights gained from grandmothers' raising of their grandchildren to the body of knowledge in the area of grandmother participation in grandchildren's mathematics learning. In addition, the study served to inform teachers, provincial curriculum developers and researchers of intergenerational parents' contributions to, and the opportunities they create for, children's mathematics learning settings at home. More specifically, since similar studies have paid more attention to parental involvement in preschool mathematics (Brosnan & Hartong, 2011). This study focused on grandmother participation in mathematics

learning of their grandchildren through home activities; and the significance this participation plays in promoting mathematical skills which yield positive learner attitudes, increased self-esteem, progress and confidence of these learners.

1.9. Delimitation of the study

This study was restricted to six grandmother-headed households and three Grade 2 teachers within the East London Education District of the Eastern Cape Province. The participants were six grandmothers and three Grade 2 teachers. The researcher was investigating home activities grandmothers engage their grandchildren in that may promote mathematical skills of Grade 2 Foundation Phase leaners, even though acknowledging that promotion of mathematical skills should be done across all grades.

1.10. Definition of key terms

The following frequently used terms are defined:

1.10.1. Parent Involvement

Parental involvement is a combination of commitment and active participation on the part of the parent to the school and to the student (Okeke, 2014). It includes several different forms of participation in education and within the schools. The context of parental involvement has been used in this paper to describe a situation in which parents are perceived as active partners in the process of educating their children. Brown & Duku, (2008) note that the “concept entails awareness of, and achievement in, schoolwork, an understanding of the interaction between parenting skills and learner success in schooling, and a commitment to consistent communication with educators about learner progress.”

1.10.2. Grandmother- headed household

Makalima (2010) explains grandmother-headed household as a family where grandmothers provide full-time parental care in the absence, illness or death of the biological parent(s).

1.10.3. Grade 2 foundation phase learners

This refers to grade R to 3, and includes children from six to nine years of age. Grade 2 is the seven-year-old learners in Foundation Phase (Department of Basic Education, 2012). Subjects in this grade are Life Skills, Mathematics and Language. This study will focus on the promotion of mathematical skills of Grade 2 learners.

1.10.4. Mathematics

According Melhuish et al. (2008), the term mathematics has several meanings. Other scholars add that mathematics is a language that makes use of symbols and notations for describing numerical, geometric and graphical relationships (Eurydice, 2011; Howie, 2006). However, for the purpose of this study, mathematics is a science to do with computations, measurements and problem-solving which everyone requires to use in one way or another (Tatira, Mutambara, & Chagwiza, 2012). People have to count money, beasts, and other things, as well as determine prices, time, areas, boundary fences, costs, and capacity.

1.10.5. Promotion of mathematical skills

Mathematics is promoted principally by being actively involved in a variety of activities that provide magnitude opportunities for children to read and write numbers, count and write (Geetha, Ramani, & Siegler, 2014). Ginsburg, Lee, & Boyd (2008) state that home-school collaboration is of paramount importance in promoting children's mathematical skills.

1.10.6. Home activities

Home activities are any tasks assigned by parents intended for children to carry out at home (Cooper, 2006). These home activities comprise of videos, games, gardening, shopping, reading labels, cooking and shoe box and the planning of family events. The practice of home activities has been used in this study to identify activities that may promote children's mathematics.

1.11. Theoretical framework

This study was guided by Pragmatism Theory, often referred to as “theory of truth”. The term pragmatism is derived from the Greek word pragma (meaning deed, work or act), which is a derivative of the word prassō, meaning to pass over, to practice, and or to achieve (Hannes & Lockwood, 2011; Singh, 2007). This theory emphasizes the learning process as practical process, or achieving learning through practical experiences (Hannes & Lockwood, 2011; Singh, 2007). The preference to use the Pragmatism approach was signified by its practicality, cooperation, prudence and a clear goal orientation in dealing with problems to determine what improves mathematical skills of Grade 2 Foundation Phase learners (Doane & Varcoe, 2005).

1.12. Research methods and methodology

1.12.1. Research Paradigm - Interpretive

The proposed study was conducted by applying the qualitative approach following the route of interpretive paradigm as the underlying philosophy (Packer, 2011). Interpretivist approach assumes that meaning of human action is inherent in the action itself and the task of this inquiry is to unearth that meaning (Lapan, Quartaroli, & Riemer, 2011). Similarly, Lithtman (2010) stated that interpretive researchers are interested in the meaning that people make of a phenomenon which, in the case of this study, is home activities grandmothers engage their grade 2 grandchildren in that maybe linked to promoting mathematical skills of grade 2 foundation phase learners. Cohen, Manion, and Morrison (2007) contended that researchers use constructs such as culture, social context and language to build their view of the world and that social reality is shaped through social interactions. Thus providing an opportunity for the voice, concerns and practices of research participants.

1.12.2. Research Approach: Qualitative

Qualitative research is concerned with the understanding of how a particular individual or group of individuals think, and the meanings they attach to their actions (Okeke & van Wyk, 2015). The purpose of this study was to explore home activities grandmothers in grandmother-headed households engage their grandchildren in that

may promote Grade 2 mathematical skills in Areas of the East London Education District. The essence of this has been captured through Pragmatism Theory, as mentioned earlier. The research question that was under investigation was: *What home activities do grandmothers engage their Grade 2 grandchildren in that may promote mathematical skills?* In order to investigate home activities grandmothers, engage their Grade 2 grandchildren in that may promote mathematical skills, the researcher decided to employ qualitative research.

The choice of this approach was motivated by Creswell (2010) who explained that the main focus in qualitative research is to understand, explain, explore, discover and clarify situations, feelings, perceptions, attitudes, values, beliefs and practices of a group of people. This study, therefore, strived to answer the research questions by explaining, describing, and making sense of the respondents, “grandmothers” social world “home activities” they engage their grandchildren in that may promote grade 2 mathematical skills.

1.12.3. Research Design: Case study

The case study was chosen as a research design for this study. Creswell (2010) stated that a case study describes the procedures for conducting the study, including when, from whom, under what conditions the data will be obtained. This study aimed at investigating in depth the home activities grandmothers engage their Grade 2 grandchildren in that may promote their mathematical skills. In order to describe home activities, grandmothers engage their Grade 2 grandchildren in that may promote their mathematical skills a case study research design was chosen for this study. Therefore, the case in this study were six grandmother-headed households.

1.12.4. Sampling and sampling techniques

1.12.4.1. Snowballing

The study employed a snowball sampling technique, which is defined as the one in which the researcher collects data on the few members of the targeted population., For this study snowballing sampling was used to locate grandmothers heading households and raising Grade 2 Foundation Phase learners. This meant sampling of grandmothers was dependent on anyone who is identified as a grandmother heading

a household and raising a Grade 2 learner introduced by other members in the population whom they know her (Mutendwahothe, 2011). In fact, since these had to be grandmothers who are raising their grandchildren, a comparative commonness, as statistics indicated, they are likely to know other grandmother-headed households with Grade 2 foundation phase learners. The study was based on the assumption that the grandmothers that will be studied would be able to describe what home activities they use to promote mathematical skills of grade 2 learners. The initial participant, who happens to be known to the researcher, referred the researcher to other participants. This process continued until all possible contacts had been tracked down.

1.12.4.2. Purposive

Purposive sampling was also used to select the Grade 2 teachers. Purposive sampling as defined by Creswell (2010) is a sampling approach whereby participants are selected because of the data they hold, or represent for the study and thus the sampling decisions are made the explicit purpose of obtaining the richest possible source of information to answer the research questions. With purposive sampling the researcher recognizes that there may be inherent variation in the population of interest (Mutendwahothe, 2011). The researcher attempts to control this by using subjective judgment to select a sample that the researcher believes to be a representative of the population. For this study, I needed three Grade two teachers, who teach Grade 2 learners in a primary school in the East London District. Grade 2 teachers who had a complete experience of teaching Grade 2 learners in rural, township and urban areas were purposively selected. The purposive sampling is supported by Glesne' s (2015) who claims that many qualitative researchers employ purposive methods as they seek out groups, settings and individuals where processes being studied are most likely to occur.I take further guidance from McMillan and Schumacher (2010) who assert that, in purposive sampling, the researcher selects particular elements from the population that will be representative or informative about the topic of interest, on the basis of the researcher's knowledge of a population; a judgment is made about which subjects should be selected to provide the best information to address the purpose of the research. In this study, I

therefore purposefully selected three Grade 2 teachers in East London, rural, township and urban in the East London Education District.

Thus, this sampling technique fitted this study, as the purpose of the study was to explore a wide range of home activities in grandmother-headed households that can be used to develop and instil grade 2 learners' with the view to promote their mathematical skills in the East London Education District.

1.12.5. Data collection techniques

Shadowing and interviews were employed as data collection techniques in this study. Shadowing is defined as a researcher closely following a subject over a period of time to investigate that people actually do in the course of their everyday lives, not what their roles dictate of them (Quinlan, 2008). Shadowing befitted the purpose of the study as the study sought to explore home activities grandmothers do that can be used to promote mathematical skills of grade 2 foundation phase learners. The researcher intended to closely follow these families to see what they do. A sample of six grandmother-headed households was shadowed.

Czarniawaska (2007) argued that an interview is a face to face conversational engagement between two people where questions are asked by the interviewer in order to elicit responses that can be analysed within qualitative research situations. Gill, Barbour, & Dean (2014) maintained that people will disclose things in face–to-face interview that they would not disclose in any ways of gathering the data from them. This study found it important to gain one on one interviews from both grandmothers raising children in Grade 2 and Grade 2 foundation phase teachers. Grandmothers were interviewed in an attempt to understand their perceptions on their role in promoting their grandchildren's mathematical skills. Three Grade 2 teachers in three primary schools and six grandmothers were interviewed. Semi-structured interview questions were designed to obtain the necessary information.

1.13. Data analysis

The data analysis in an interpretive research is quite lengthy and time consuming because of the large quantities of data, which are not usually organised in a manner

that facilitates analysis (Feza, 2015). The data analysis was unfolded as a continuous process, starting from the initial meeting with grandmothers and also foundation phase learners. Both content and thematic analysis were used to analyse the data generated from this study. The study followed the proposed five steps by Glesne (2015) in data analysis, namely; data managing, reading, describing the context and participants; classifying, and interpreting the data. Classifying the data, the fourth step in analysing interpretive data, entails breaking down the interpretive data through the process of coding or classifying (Glesne, 2015). When the concepts in the data were examined and compared to one another connections were made, and categories were then formed. Categories were used to organise similar concepts into distinct groups (Feza, 2015). The categories were used to provide the basis for structuring analysis and interpretation.

1.14. Credibility and trustworthiness

In qualitative research, the researcher mostly acts as a data gathering instrument. Thus, credibility and trustworthiness is of utmost importance. According to Niewenhuis (2008) through different ways, we can enhance trustworthiness.

1.14.1. Using multiple data sources.

Using multiple data sources can help check the findings. In this study, the researcher used various data sources to collect data, such as (children's scrap book) generated through four formatives, one summative and one oral assessment and transcripts of interviews.

1.14.2. Verifying raw data

Once the transcripts were coded/ created from focus group interviews, they were given to the participants to verify the correctness and accuracies between their views expressed and reflected in the transcripts.

1.14.3. Stakeholder checks

Once the conclusions were drawn, participants were given a chance to comment on whether the researcher's interpretations are in line with the personal experiences that they have tried to express through the focus groups interviews.

1.15. Ethical issues

Sotuku & Duku (2015) argued that practicing ethics is a complex matter that involves more than just following a set of static guidelines such as those from a professional association. Ethically, conducting research requires researchers to actively interpret these principles for their individual projects, tailoring these ethical guidelines to suit the unique contexts of their research. The following was observed:

1.15.1. Gaining permission

The researcher submitted a letter requesting permission to conduct the study from the Faculty of Education Research Ethics Committee, of the participating University. The researcher conducted the study after receiving Ethical Clearance Certificate from the University Research Ethics Committee (Sotuku & Duku, 2015).

1.15.2. Participants' right

The participants were allowed to exercise their right to be part of the research or not (Sotuku & Duku, 2015). Participants' right to privacy was respected and that of the University where the participants are studying. Participants were informed that they have a right to discontinue with participation if they feel so.

1.15.3. Informed consent

With regards to informed consent, Sotuku & Duku (2015) have quoted the National Commission for the Protection of Human Subjects which states that "all informed-consent procedures must meet three criteria: participants must be competent to give consent; sufficient information must be provided to allow for a reasoned decision;

and consent must be voluntary and un-coerced." Participants were given all the information that helped them voluntarily participate in the study.

1.15.4. Confidentiality and anonymity

All information obtained in this study will be treated confidentially and will not be divulged to anyone. The researcher understands that it is unethical to be negligent in not protecting the confidentiality and anonymity of the information gathered from the participants (Sotuku & Duku, 2015). Furthermore, the study used pseudonyms which will be applied to research participants, and the site where the participants stay and learn.

1.15.5. Protection from harm

According to Sotuku & Duku (2015) protection from discomfort and harm originates from the principle of beneficence which refers to doing good and the avoidance of doing harm. During all interaction with research participants, the researcher avoided any situation that could have led to unwarranted distress and discomfort on the part of the participants.

1.15.6. Maintaining professionalism

Sotuku & Duku (2015) expounds that the researcher is committed to a continuous professional development, ethical practice, and responsible attitude toward participants. This was done through demonstrating respect, compassion, integrity and altruism in the relationship with the participants. The researcher provided competent performance with the participants.

1.16. Outline of chapters

Chapter one: Introduction and Background of the Study

This chapter introduced the study by presenting the background of the study, statement of the problem, purpose of the study, research questions, objectives of the study, significance of the study, delimitations and definitions of terms.

Chapter two: Literature Review

Literature review was divided into two parts, of which part one discussed the theoretical framework of the study and then reviewed literature based on the research questions of the study.

Chapter three: Research Methodology

This chapter outlined the research methodology of the study. It spelt out the research paradigm, research approach, research design, population, sample and sampling, data collection instruments and procedures, credibility and trustworthiness, data analysis procedures and ethical considerations.

Chapter four: Data Analysis, Interpretation and Presentation of Findings

This chapter analysed and presented data collected. It explained how the data was analysed using content analysis created from the main research questions.

Chapter five: Discussion, Recommendations and Conclusion

The final chapter of this study focussed on discussion of the findings of the study. The study concluded by offering recommendations which emanate from the discussion.

1.17. Summary

This chapter dealt with the background of parental involvement and the policies that the government has put in place for parents to be involved in their children's education. It further described the statement of the problem, research questions, significance of the study, and delimitations of the study. Chapter two will review the theoretical framework that informed the study and reviews literature in line with the research questions

Chapter 2

Literature Review

2.1. Introduction

This chapter aimed to explore the nature of home activities grandmothers engage their Grade 2 grandchildren in to promote mathematical skills of Foundation Phase leaners. The literature review focused firstly on the theoretical perspective within the study which provided insight the nature of home-based activities parents engages at home to promote mathematical skill.

The chapter, secondly, explored conceptual analysis of mathematics in South African curriculum and learner performance. Thirdly, parental participation in children's mathematics education as well as parent-educator partnership. The chapter culminate with the conceptualisation of grandmother-headed household. The literature is reviewed in this chapter to answer the following main research question:

What home activities do grandmothers use that may promote mathematical skills of Grade 2 Foundation Phase Learners?

2.2. Theoretical framework: Pragmatism theory

This study employed the key aspects of the Pragmatism theoretical perspective deriving from Dewey's work is often referred to as "theory of truth" (Pierce, 1907; Dewey, 1931; James, 1907). This theory emphasizes the learning process as practical process, or achieving learning through practical experiences (Hannes & Lockwood, 2011; Singh, 2007). The preference to use the Pragmatism approach was signified by its practicality, cooperation, prudence and a clear goal orientation in dealing with problems to determine what improves mathematical skills of Grade 2 Foundation Phase learners (Doane & Varcoe, 2005).

In Fredrichs and Kratochwili (2009) states that pragmatism should be considered as a "forum in which people can talk how to fulfil their needs, and which beliefs to get them what they want. This implies that schools and parents should form effective

partnership that sought to promote the low level of children's mathematics' performance. Pragmatism has been considered to be a useful lens that can help in understanding debates and discourses in complex situations (Dewey, 1931; Trohler & Oelkers, 2005). In the case of this study, pragmatism perspectives can be used to understand the complex discourses around significant numbers of South Africans, who are at risk of not developing the mathematical skills needed to fully participate in the economy nationally and globally (Spaull, 2011). These discourses emanates from the reality that society requires mathematical knowledge in order to survive and prosper, and that South African society is far behind in attaining this knowledge (Spaull, 2011).This has been exacerbated by the fact that ordinary people fail to see the everyday application of school mathematics, rather, they perceive it as something abstract and cold (Moloi, 2006; Bansilal, James, & Naidoo, 2010; Feza, 2015).Thus, the study sought to explore children's everyday home practices that help link mathematics with everyday life in the classroom, so as to help mathematics concept-formation and drive away the fear of the subject amongst Grade 2 learners. Pragmatism is therefore related to real-world applications of knowledge and skills attained by learners as a product of schooling (Dewey, 1897, 1973).

Pragmatists see their action as driven by dialectics, a process of arriving at truth through confrontation of different points of view (Doane & Varcoe, 2005). Thus, the study is driven by the problems that emanates in grandmother-headed household. To the pragmatists what is true is what works best in enabling one to overcome an immediate problem (Fredrichs & Kratochwili, 2009). This complements the purpose of this study as it sought to help in designing of research-based intervention of parenting practices to promote mathematics skills of young children.

Pragmatism has been considered to be a useful lens that can help in understanding debates and discourses in complex situations (Dewey, 1931; Trohler & Oelkers, 2005). Significant numbers of South Africans, across all age groups are at risk of not developing the mathematical skills needed to fully participate in the economy nationally and globally (Spaull, 2011). Consequently, education reformers in South Africa are concerned about mathematics education because of the apparent inability of South African learners to compete successfully with their peers from other countries in global mathematics tests (TIMMS, 2011; SACMEC, 2006). This has

been exacerbated by the fact that ordinary people fail to see the everyday application of school mathematics, rather, they perceive it as something abstract and cold (Moloi, 2006; Bansilal, James, & Naidoo, 2010; Feza, 2015). Thus, the study sought to explore children's everyday home practices that help link mathematics with everyday life in the classroom, so as to help mathematics concept-formation and drive away the fear of the subject amongst Grade 2 learners. Pragmatism is, therefore, related to real-world applications of knowledge and skills attained by learners as a product of schooling (Dewey, 1897, 1973).

Pragmatism is also viewed as a philosophy that invites deep commitment to practice. Pragmatists see their action as driven by dialectics, a process of arriving at truth through confrontation of different points of view (Doane & Varcoe, 2005). Hence, the most common interpretation of the term pragmatism is applying what works best, making it a philosophy or theory of 'workability' (Fredrichs & Kratochwili, 2009). To the pragmatists, what is true is what works best in enabling one to overcome an immediate problem (Graham, & Tetroe, 2007). They also view knowledge in terms of its ability to work and provide satisfactory impacts.

Singh (2007) claims that pragmatism does not believe in fixed aims of educational research, because human needs always change with changing times, places and circumstances. It is noted by this author that no specific aims, frameworks and methods of educational research can hold true and be applicable at all times, or in all places or situations. It is, therefore, necessary to have aims that enable the researcher to continuously grow and create new values, which provide him/her with dynamic direction and guidance towards intrinsic interest, strong attitude and capacities in their areas of specialization. In the context of this paper, pragmatism is relevance to this study is as described in the sub-sections that follow.

2.2.1. Pluralistic view in addressing research issues

Pragmatism embraces the notion of plural and dynamic realities (multiple truths) or, in other words, that there is no knowledge that is certain and/or universal. This implies that the promotion of mathematics is complex and required to be explored in a variety of contexts such as culture, everyday activities, fun and games (Chikodzi &

Nyota, 2010). Pragmatism not only rejects the narrow confines and structures of absolutism but also offers an approach grounded in the emerging conversation that supports a diversity of viewpoints about the phenomena (Fredrichs & Kratochwili, 2009; Doane & Varcoe, 2005). Unlike other worldviews, pragmatism is not informed by formal theory, but by accumulated practices, practitioner and administrator knowledge, the findings from previous research and the views expressed by the public (Hannes & Lockwood, 2011).

2.2.2. Emphasis on what works best in solving educational issues

Pragmatism emphasizes what works best, that is, finding a measure of goodness that works rather than what may be 'inherently' true as celebrated by positivists (Morgan, 2007). Pragmatism is well known for its emphasis on utility of all educational practices in that only those subjects, activities and experiences that are useful to the present needs of the learner and that meet the future expectations of adult life are included in the curriculum (Morgan, 2007). Doane and Varcoe (2005) look at pragmatism as a philosophical movement that stresses practical consequences and values as standards by which concepts are to be analysed and their validity determined. In other words, pragmatism is the philosophical notion that ideas or principles are true so far as they work. In Doane and Varcoe's view, pragmatism heavily relies on empirical or experimental methods and rejects patriotism (innate or intuitive processes and mechanisms of knowing) as a source of human knowledge. In this paper pragmatism is also viewed as the world view that is likely to provide an avenue to test the utility of linking home activities to Grade 2 mathematical learning; here, utility could be related to the increase of mathematical skills in foundation phase learners in South Africa. The assumption that this paper holds is that the utility of linking home activities with Grade 2 school mathematics should be the first benchmark for judging whether the teaching of mathematics is effective or not.

2.2.3. Assertion of connecting theory to practice

Pragmatists believe that knowledge results through interactions (action or doing) in which the individuals interacting in experience and later use this knowledge to solve subsequent problems (Levin & Greenwood, 2011). Thus this study believes that children's mathematical skills can be promoted through engaging and interacting in home activities with their grandmothers.

2.2.4. Pragmatism in Education:

In the present world, pragmatism has influenced education tremendously. It is a practical and utilitarian philosophy. This means construction of knowledge is based on practical experiences. It makes activity the basis of all teaching and learning. This implies that it is an activity around which an educational process revolves. It makes learning purposeful and infuses a sense of reality in education (Levin & Greenwood, 2011). This means schools should aim to provide children with variety of opportunities in which children can practice mathematics. This gives an experimental character to education. Pragmatism makes learners optimistic, energetic and active and gives him self-confidence. Therefore, by linking mathematics in the home and mathematics at school children' Grade 2 learners will be eager to learn mathematics and their self-esteem will be boosted which later will develop the love of mathematics. This approach assists the child to create values through his own activities. This means education must make apply children's everyday experiences to make education a social function, and should provide real-life experience to the child. Therefore, the main aim of education, according to pragmatism, is to enable the child to create values in his life through applying his/her own experiences in what they learn. Hence, the aim of this study is to assist grandmothers and teachers recognize possible connections between the formal curriculum (mathematics) and home based mathematics.

The pragmatists advocate that the pupils should not be taught dead facts and theories because these may not help them to solve the problems of life (Levin & Greenwood, 2011). This advocacy is congruent to that of this study to the fact that it believes that children's everyday chores can help children make connections. This

approach does not only prepare the child to for schooling but prepare the child for a successful and well- adjusted life. The pragmatists hold the view that the students should acquire that knowledge which is helpful to them in solving the present-day problems (Levin & Greenwood, 2011). According to pragmatism, all education is "learning by doing". This implies that education must be based on the child's experiences as well as occupations and activities (Morgan, 2007). Besides the school subjects, free, purposive and socialized activities should be in the curriculum.

2.2.5. Pragmatism and Methods of Teaching

The principle of philosophy of pragmatic method of teaching is practical utility. This means teaching methods used by schools must draw on children's prior knowledge. The child is the central figure in this method (Morgan, 2007). This means teaching methods must be child centered and learning must be through personal experience of the child. To a pragmatist, education means preparation for practical life (Levin & Greenwood, 2011). The child should know the art of successful tackling of practical problems and real situations of life. Pragmatic method is, thus, a problem-solving method. The child has to be placed in real situations which he has to tackle. This validates the purpose of this study's as the purpose of this study.

"Learning by doing" is the great maxim of pragmatic education (Levin & Greenwood, 2011). To these pragmatists, "education is not so much teaching the child things he ought to know, as encouraging him to learn for him through experimental and creative activity." Learning by doing makes a person creative, confident and cooperative. The pragmatic method is socialistic in nature (Morgan, 2007). The child's learning should be thoroughly purposive. Children should learn to fulfil the purpose of his life.

The method employed by the pragmatist teacher is experimental (Levin & Greenwood, 2011). Children are required to discover the truth for themselves through using their out of school experiences. To facilitate this discovery, the application of the child everyday life experience and exploratory methods of teaching is necessary. Experiences should, therefore, be planned to arouse the curiosity of children to acquire knowledge (Morgan, 2007). Therefore, Grade 2 mathematics

teachers are to teach their learners by acting upon experiences rather than to know abstractly. Grade 2 teachers also need to plan lesson in a way that children will be to discover information for themselves rather than to collect dry information from teachers. Therefore, it is the teachers' responsibility to arouse "interest" in children mathematics and this can be done through linking school mathematics with mathematics found at home. Interest is a watchword in pragmatic education (Bryman, 2012).

Textbooks and teachers are not so much important in pragmatic education. Their position is secondary in the teaching-learning process (Morgan, 2007). They are required to suggest and prompt only. The teacher suggests problems, indicates the lines of active solution and then leaves the students to experiment for themselves. The child learns for himself.

Pragmatic method is a Project Method which is of American origin. A project is a whole-hearted purposeful activity, proceeding in a social environment. The project method is an educational enterprise in which children solve a practical problem over a period of several days or weeks. It may involve building a rocket, designing a playground, or publishing a class newspaper. The projects may be suggested by the teacher, but they are planned and executed as far as possible by the students themselves, individually or in groups. Project work focuses on applying, not imparting, specific knowledge or skills, and on improving student involvement and motivation in order to foster independent thinking, self-confidence, and social responsibility. The school tasks, therefore, should be such that they arouse the eagerness of the children to do them (Morgan, 2007). For the teaching of mathematics tasks such as home-based activities are real, purposeful and related to children's life are therefore can be used to arouse children's interest in learning mathematics. The projects involve participation in social relationships, division of labour, and willingness of acceptance of responsibility to the community and to afford valuable preparation for playing a worthy part in a complex society (Anaduaka, 2010). This project reinforces parent-teacher partnership and acknowledges that children's mathematics education is the responsibility of the society. Through this approach teacher requires only the child and his "physical and social environment."

This implies that teachers need to understand children's culture, history, language and background in order for children to react to school environment.

2.2.6. Pragmatism and the Teacher:

According to Pragmatism, a teacher is useful, even though not indispensable (Fredrichs & Kratochwili, 2009). The position of the teacher is of a guide and adviser; Teachers are seen as helpers and prompters. In the case of mathematics teachers are expected to provide children with familiar activities to teach mathematics. For example, for sorting and teachers can make use of laundry, before children do laundry they are expected to sort clothing items according to their colures. The teacher should teach "his learners to think and act for themselves to do rather than to know, to originate rather than to repeat" (Morgan, 2007). Teachers' importance lies in the fact that they have to suggest suitable problems only to their students and to motivate them in such a way that they can solve the problems with tact, intelligence and cooperation (Anderson, 2007). They are not required to provide raw information to the students from the textbooks. The pupils will gain knowledge and skill at their own initiative. Doing is more important than knowing (Morgan, 2007).

Through this model, in order to promote children's mathematical skills, the understanding of what they engage in in their everyday lived is of paramount important. Therefore, exploring what grandmothers engage their Grade 2 grandchildren will give insight of majority of children in South do in their everyday lives that can be used to promote children's mathematical skills.

2.3. Conceptual analysis: Mathematics

Mathematics is a language that makes use of symbols and notations for describing numerical, geometric and graphical relationships. It is a human activity that involves observing, representing and investigating patterns and qualitative relationships in physical and social phenomena and between mathematical objects themselves. It helps to mental processes that enhance logical and critical thinking, accuracy and problem-solving that will contribute to decision-making (DBE, 2012).

2.3.1. South African curriculum

The South African curriculum aims to ensure that children acquire and apply knowledge and skills in ways that are meaningful to their own lives, creating learners who are able to identify and solve problems and make decisions using critical and creative thinking. Since 1994 South Africa has tried to improve the implementation of the curriculum by repackaging the curriculum in various ways in order to improve the quality of teaching and learning. The current curriculum which is the Curriculum and Assessment Policy Statement (CAPS) is regarded as having simplified and made clear content coverage (Machaba, 2013). The South African curriculum aims at ensuring that children acquire and apply knowledge, skills and values necessary for self-fulfilment and participation in society. It further acknowledges that for people to participate effectively in society they must know basic mathematics. Mathematics is therefore regarded as a very powerful “gate keeper”. It is critical for children to develop strong number sense, to be able to perform basic operations, to know the basic number facts and to perform mental arithmetic with confidence (DOE, 2002). For children to use and apply the mathematics they learn at school they need to experience mathematics as a meaningful, interesting and worthwhile activity. Thus, this study sought to investigate what children do in their everyday lives. The Foundation Phase Mathematics Curriculum and Assessment Policy Statement (CAPS) require Grade 2 learner to master the following Grade 2 mathematical skills.

2.3.1.1. Numbers concept, operations and relationships and Money

Number concept operations and relationships are the most important and the main focus of mathematics at foundation phase. Learners are expected to exit the foundation phase with a secure number sense and operational fluency.

2.3.1.2. Number Concept

Number concept is the ability to count accurately-fast forward and is suggested to be first functional mathematical skill Grade 2 learners are expected to master. Then later children will learn to count backwards. A more complex skill related to number concept is the ability to see relationship between numbers- like adding and

subtracting. This includes recognition of numbers and number words, various means of counting and the use and understanding of ordinals.

2.3.1.3. Number Operations

It is imperative that primary-grade children have a good grasp on both the concept and execution of addition, subtraction; solve word problems in context and explain own solution to problems involving addition, subtraction with answers up to 99. Additionally, children should be taught how to estimate. This is the ability to make a good guess about the amount or size of something. Additionally, Grade 2 learners are expected to recognize the place value of at least two digits' numbers to 99 numbers;

2.3.1.4. Relationships

Mathematics is all about finding and studying patterns and relationships. Not only is it a study of numbers and concepts, but it is the process of seeing how those numbers and concepts interact and relate to one another. This particular focus evokes the child's curiosity and independent thinking, as well as his sense of logic. Thus grade 2 learners are expected to do repeated addition leading to multiplication; grouping and sharing leading to division; grouping and sharing leading to division.

2.3.1.5. Money

Grade 2 learners are required to recognize and identify the South African coins. Solve money problems involving totals and change to R99 and in cents up to 90c.Even at an early age, children should understand about money and be able to determine whether or not they have sufficient funds to buy a particular item. Problem solving skill is the ability to think through a problem, to recognize there is more than one path to the answer, it means using past knowledge and logical thinking skills to find an answer.

2.3.1.6. Patterns, functions and algebra

Patterns are things – numbers, shapes, images that repeat in a logical way. Patterns help children learn predictions, to understand what comes next, to make logic connections, and to use reasoning skills.

2.3.1.7. Space and Shape

In the area of space and shape, Grade 2 learners are required to recognize, name, sort and compare 2-D and 3-D objects; circles, triangles, squares, rectangles as well as describe, sort and compare 2-D shapes in terms of: size, colour, shape, straight sides and to recognize and draw line of symmetry 2-D, geometrical and non-geometrical shapes.

2.3.1.8. Measurement and Time

Grade 2 learners are required to tell time and understand its passage, as well as comprehend various means of measuring; measurement of time; to estimate length, measure, compare, order and record length using non-standard measures.

2.3.1.9. Data handling

In the area of data handling, Grade 2 learners are required to master mathematical skills such as collecting and organizing data about the class or school to answer questions posed by the teacher, organize data in tallies, represent data in pictograph, analyses and interpret data by answering questions about data in pictograph.

CAPS further stipulate that in order for children in this phase master such skills learners should:

- develop the correct use of the language of mathematics;
- develop number vocabulary, number concept and calculation and application skills

- learn to listen, communicate, think, reason logically and apply the mathematical knowledge gained;
- learn to investigate, analyses, represent and interpret information;
- learn to pose and solve problems; and
- build an awareness of the important role that Mathematics plays in real-life situations, including the personal development of the learner.

Mitchlmore & White (2007) as well as the Columbia (2012) asserted that learners need communication in order to learn mathematics and to communicate mathematically. Classroom discussions can, therefore, be exploited to encourage learners' meaning making and to reveal their growth of mathematical understanding (Patkin, 2011). The interplay of learners' everyday language and mathematical language is recommended (Patkin, 2011& Columbia, 2012). This will assist children in extracting the concepts of mathematics elements (ibid). For instance, informal classroom discussions in the learners' vernacular of home language can, therefore, enhance learners' growth of mathematical understanding and number vocabulary (Goral & Gnadinger, 2008). It will also encourage Grade 2 learner to talk about what they are doing using their new mathematical vocabulary (South Africa, 2000). Patkin (2011) corroborate this assertion and believe that the interplay of learners' daily language and mathematical language will enhance learners' mathematical understanding. Language use encourages active engagement of learner in mathematics. It also encourages cooperative learning which will enhance learners' communication, connecting, problem- solving, and representation as well as reasoning process skills.

2.3.2. South Africa learner performance in mathematics

South Africa participated in the Trends International Mathematics and Science Study (TIMSS) in 2003 and the Southern and Eastern Africa Consortium for Monitoring Educational Quality (SACMEQ) in 2006. The results of both national and international studies show that South African did not achieve the required international average scores and was placed at the bottom of the lists. The results of

the assessment revealed that more emphasis is placed on children being able to think mathematically than on children being able to calculate (Howie, 2006; Maree, Feza, 2015).

The top priority for the South African government on which the Department of Basic Education (DBE) has to deliver is to improve the quality of basic education. The Annual National Assessment (ANA) is a critical measure to assess the progress in learner achievement. Poor performance of learners in numeracy has been an on-going problem in South Africa. The South Africa's Systematic Evaluation program which tested Grade 3 learners using a standardized test in 2007 found that the performance of learners in mathematics was at 43 percent (DOE, 2012). The key problems that were identified appeared to be in the classroom, the incapacity of teachers to identify and apply appropriate teaching methods, teachers with insufficient training and learners who were given too few opportunities to solve problems on their own. Lack of solid numeracy skills will hinder learner's effective learning in other fields of knowledge (DOE, 2011). Other factors that contribute to poor performance are socio-economic factors, demographics and the historical realities of South Africa. Learners in schools with high poverty levels perform poorly in mathematics (Simkins & Spaull, 2013) and consistently achieve much lower learning outcomes than their counter parts in the urban areas. Also in the predominantly rural and historically disadvantaged provinces there is evidence of poor learner achievement (Bayanga, Mtose, & Quan-Baffour, 2010). In the Eastern Cape (EC) province where the study will be conducted, mathematics performance for grade 1, 2 and 3 stood at 64.5%, 57, 7% and 48.8% respectively (DOE, 2015). These findings reveal a decline in mathematics performance as children proceed to higher grades.

The South African government has introduced many intervention strategies with regard to poor mathematics performance (DOE, 2012). The introduction of Foundations for Learning (FFL) in 2008 to improve mathematics represented a major shift towards providing better methodology and guidance to teachers and ensuring the learners have the materials they need. The National Department of Basic Education (DBE) workbooks were introduced to support the quality of teaching and learning. In 2008 and 2009 trials runs of the Annual National Assessment (ANA)

were conducted with a special focus on exposing teachers to better assessment practices and to monitor the extent to which the outcomes of improving the quality and the levels of education are achieved. However, despite these intervention strategies mathematics achievement has been incessantly below expected standards relative to other subjects. This has been exacerbated by the fact that ordinary people fail to see the everyday application of school mathematics, rather, they perceive it as something abstract and cold, (Bansilal, James, & Naidoo, 2010). Other recent factors that have been identified to contribute to poor performance is the divorce of mathematics to children's everyday lives (Tatira, Mutambara, & Chagwiza, 2012).

The 2011 ANA provided the first national baseline to benchmark annual targets and achievement of 60 percent learner attainment by 2014. It produced sufficiently standardized data in order to allow for the analysis that aimed to enable provinces and districts to support the schools at Foundation Phase. The key findings were that only thirty percent of foundation phase learners were able to do mathematics. Realizing that this problem was systemic from the Foundation Phase onwards, the Basic Education Department has focused on improving the schooling in the Foundation Phase.

2.4. Parental involvement in children's mathematics

The Curriculum Assessment Policy Statement (CAPS) also legislates that parents and the wider community have an important role to play in curriculum management (Education, 2012). CAPS further identifies the benefits of community and parental involvement to include improved school performance, reduced drop-out rates, a decrease in disciplinary problems and, generally, a more positive attitude towards the school (ibid). Parental involvement in their children's learning is an educational topic which has received growing attention in the last few decades. Parental involvement in the education of their children can be described as the active and willing participation of parents in a wide range of school-based and home-based activities which may be educational or non-educational (Lemmer, 2013).This view is in line with Pragmatism which does not only reject the narrow confines and structures of absolutism but also offers an approach grounded in the emerging

conversation that supports a diversity of viewpoints about the phenomena (Creswell, 2003; Rorty, 2004; Rosamond, 2007); in the case of this study, the recognition of funds of knowledge grandmothers can contribute in promoting Grade 2 mathematical skills.

Parental assistance to their children in different learning tasks is considered as one of important examples of the social interaction ideas proposed by the pragmatism scholars. For example, parental support for children in the home environment can significantly contribute to children's learning in the early years of childhood (Benigno & Ellis, 2008; Feiler,2010). At home, good parenting such as providing a good foundation of skills, values, attitudes and self-concept, is more likely to have a positive effect on children's learning and adjustment (Anthony & Walshaw, 2007).

The traditional stance of home-school relationships tends to be oriented toward the 'one size fits all' approach (Epstein, 2011b). In most cases, the approach privileges the typical (middle-class and mono-cultural) families and often marginalises other families such as low socioeconomic level, low education, and minority groups (Yaro, 2015). Recent parental involvement studies and initiatives have tried to move beyond the traditional stance which favours school-centred parental involvement activities. On the other hand, these traditional activities tend to consider families from disadvantaged backgrounds (e.g. from working-class, ethnic minorities, or low income backgrounds) as deficient (Edward, 2006).

The new perspectives in home-school relationships reject this deficit view and move towards promoting more acknowledgment and the utilisation of the cultural and social resources which are called by some researchers as funds of knowledge (Dor, 2012) or cultural and social capital (Okeke, 2014). In this view, every family, regardless of their economic circumstances, social class or cultural background, can provide valuable learning opportunities for their children. School should identify these resources and try to utilise them and build upon them in the classroom (Moeller & Blelfelt, 2011).

The area of parental involvement in mathematics education has been considered as a key area of study by researchers around the world. Several studies which have

investigated children's pre-school mathematics learning at home support the notion that parents can play a significant mediation role in developing their children's mathematics skills through shared activities and interactions in everyday lives (Civil, Guevara, & Allexsaht-Snider, 2007; Anderson, Anderson, Friedrich, & Kim, 2010). These activities and interactions include different practices such as engaging in household chores together, playing games and asking questions and pointing to aspects of the activity in ways that encourage children to extend their level of understanding. This study, therefore, suggests that South African schools can also infer from these studies that mathematics learning is not restricted to school lessons.

Goldman and Brooker (2009) tried to involve parents in their children's mathematics learning through shared homework in the IMPACT project. These ideas were further developed and extended by other researchers (Chikodzi & Nyota, 2010) who used the cultural community framework to investigate parents' perspectives about their children's mathematics learning and tried to know more about the relationship between children's home culture and mathematics learning. Chikodzi and Nyota's (2010) study found that parents' perceptions and experiences in learning and teaching mathematics can be different from those held by teachers or held by other parents with different social and cultural backgrounds. Parents' involvement in mathematics were based on several perceptions drawn from their own ideas and experiences as well as other perceptions growing out of environmental demands and opportunities (Chikodzi & Nyota, 2010). These perceptions suggested that most parents' fundamental decisions to become involved in their children's mathematical education was a function primarily with three constructs, the parents' perception of their role in their child life; the parents sense of usefulness for helping his/ her child success in school; the general invitation, demands and opportunities for parental involvement presented by both the parent and the child's school (Yaro, 2015). These suggestions were composed of specific sets of beliefs, experiences and behaviours that serve to position the parents in terms of their own answer(s) to the question on how they perceive their role in their children's mathematics education (ibid). These suggestions seemed to concur with Plaatjies, (2013) who investigated grandparents' influence in their grandchildren' school performance. This study revealed that grandparents view their role as surrogate parents, protectors, coach and mentors. Yaro (2015) reaffirmed these findings when he reported that parents with low

education view their role in their children mathematics learning as primary caregivers and financial providers. Based on the above perceptions that influence parents' view of their role became evident that parents become involved in their children's mathematics education because they have developed a parental role.

Civil and her colleagues tried to promote two-way dialogue about mathematics education between parents and teachers through investigating and building upon parents' perceptions and experiences and helping parents to learn more about school mathematics (Civil, Guevara, & Allexsaht-Snider, 2007). They have ability for helping children succeed and that they perceive general opportunities and invitations for involvement in their children's mathematics education. This implies that these parents understood curriculum approaches and rules of mathematics and its value and acknowledged that mathematics is embedded in their everyday lives.

This was also supported by Cai (2003) who found parental roles of school going children in their mathematics education as motivator, monitor, resource provider, mathematics content advisor, and mathematics learning counsellor (2003). This study looked at the differences in parental support provided by Chines and US parents; interestingly, only about 36% of Chinese parents indicated that they "knew enough about mathematics to help my child" (Cai, 2003). This finding seemed congruent with findings by Spaull, (2011) who argues that South African children's inability to do mathematics is associated with lack of parental involvement in children's' mathematical education. This literature seemed to be in line with Section 28 of the Bill of Rights, entitled "children". This Section gives children the right to a name, citizenship and some form of care. It further posits that children need food and shelter, and should be protected from abuse, neglect and degradation. Moreover, no child should work when under-age, or do work that would interfere with his or her education or development.

Other projects have attempted to move beyond the school-centred view which seems to characterise previous studies and initiatives and tried to find ways of creating more balance in the process of investigating and utilising home and school mathematics. For instance, Feiler (2010), tried to utilise teacher awareness about children's learning experiences at home and attempted to find ways for utilising

home mathematics resources for school mathematics teaching. Further, Feiler (2010) have developed numerous concepts through their investigation of numeracy practices at home and school. They focused particularly on how the separation of learning between home and school can have an impact on children's knowledge and development. Their concepts (e.g. classification of sites and domains of numeracy practices which take place in- and out-of-school) were particularly useful in distinguishing the various overlapping numeracy practices which take place in different contexts.

The Home School Knowledge Exchange projects by Melhuish et al. (2008) and Feiler (2010) have moved one stage further as they put some of the previous conceptual ideas into practice. They developed a new approach which emphasises mutual knowledge exchange between home and school. The project highlighted interesting aspects of home-school relationships such as conflicts between teaching strategies used at home and those used in school. The study concluded by suggesting that when designing mathematics homework teachers should take into account: providing sufficient information to parents about the required topic and its required strategies, teachers should give more recognition to the role of parents and utilising their knowledge and expertise. This implies that schools should also provide parents with opportunities which allow them to work collaboratively with their children on shared authentic mathematical tasks, and it is important to connect children's authentic home resources and everyday experiences in a meaningful way with school mathematics learning.

It is against these discourses that this study sought to use Pragmatism approach as the useful lens that can help in understanding home activities grandmothers engage their grandchildren to promote mathematical skills of Grade 2 Foundation Phase learners in South Africa.

2.5. Home activities and mathematical skills

Research is univocal with regards to the beneficial role of home activities in the development and promotion children's mathematical skills (Geetha, Ramani, & Siegler, 2014; Kleemans, Peeters, Seggers, & Verhoeven, 2012). For instance, as

part of a larger study of “The Primes Project”, Goldman and Booker (2009) in Canada worked with six families (grandparents and other family members and their middle school year’s children between ages 7-8) from diverse socio-economic backgrounds to develop observational case studies. The researcher videotaped the families in their homes, workplaces, schools and outings over several years to understand mathematics at home in order to help parents recognize possible connections, and to develop their children’s mathematics. Findings revealed that families engage in various home activities, such as building, participating in sports, playing games, fundraising for charities and causes, sewing, dancing, planning and taking family trips, and cooking were rich in contexts for mathematics in each family’s activities.

Similarly, studies of grandparents of 5-9-year-old in East London, UK, and grandparents in Bangladesh from different ethnic backgrounds echoed the same sentiments when showing that children’s mathematical skills can develop when engaging in gardening, landscaping and house design with their grandchildren (Eurydice, 2011) and landscaping and house design will often include elements of patterns (Geetha, Ramani, & Siegler, 2014). For example, many fences and or paved areas include a pattern arrangement. Children learn to identify, describe sort, measure, compare and understand conditions which expose children to number operations.

In a recent study in China, Ramani, Hirsch-Pasek, & Pan, (2014) examined 7 - and 8-year-old same-age, same-sex pairs of children from different families but same community. Since many young children are fascinated by animals, Chinese families use animals as a theme to draw these young children into the field of mathematics. Mathematics activities using animals can not only build mathematical skills, but could also increase vocabulary, build fine motor skills and improve reasoning. Young children can organise animals according to size. Other studies show that Chinese parents also used let their children to weigh produce at the grocery store and estimate the cost (Ginsburg, Lee, & Boyd, 2008). Let them pay the clerk in the store and then count money to ensure it's the correct change, children learn about volume and mass.

Children were also encouraged to play with blocks, a popular activity found in most families, which contributed to the development children's mathematical skills such as enumeration, classification, spatial reasoning, knowledge of geometric shapes, numerical knowledge, and problem-solving skills (Ramani, Hirsch-Pasek, & Pan, 2014). Children were instructed to build a house with large colourful blocks that included features of a house, such as a door and rooms, but the children were given no specific directions about how to complete it.

In Sub- Saharan countries, the role of home-based activities is highly recognized and it is expected to increase even further. From these studies, various home activities have been identified such as baking, shopping and budgeting, games, sewing have emerged as important activities used by several families in developing mathematical skills of young children (Brosnan & Hartong, 2011). Other studies show that learners also experienced mathematical skills which include board or card games that involve counting, patterns, number recognition and measurement and calculation in contexts such as cooking and carpentry (Eurydice, 2011). During sewing and knitting, decreasing and increasing the number of stitches usually follows a pattern.

In South Africa, literature showed how family cultural aspects relating to plays and home activities in Balobedu can be incorporated in the learning of mathematics in primary school (Tatira, Mutambara, & Chagwiza, 2012). These activities include home cultural games which involve reading and following instructions and making calculations, whilst household chores such as gardening, shopping, reading labels, cooking, planning events and using diary and calendar also feature prominently. Nkopodi & Mosinmenge (2009), studied mathematical concepts like symmetry, counting geometrical shapes and proportions were identified in the indigenous game of *Umlabalaba* among the Pedi and Tswana people of Limpopo and Northwest provinces, respectively.

In their action research studies, 'teacher ethnographers' in San Francisco Bay Area, USA, investigated the diverse context and activities in which families engage reveal how home activities that are rich in discourses and practices that actually instantiate a great many mathematics relevant practices. Similar connections with African American parents as educators have been built in multilingual classroom in

Philadelphia (Remillard & Jackson, 2006). These discourses suggest that daily life provides many contexts for mathematical problem solving, that parents generally can grapple with the problems they encounter productively and often to their satisfaction, and, on occasions, invoke the frames, methods of school mathematics, all while rarely identifying what they do as “mathematics”.

There are different home activities that can be used to promote mathematics. Mathematical skills such as ‘same’ or ‘different’,’ more’ or ‘less’, ‘left’ or’ right’, naming shapes and dates, encouraging sorting, symmetry, sequencing, measuring and counting and introducing concepts related to subtraction and addition, can all be promoted during home activities and free-play time (LeFevre, et al., 2009); (Chikodzi & Nyota, 2010). Furthermore, these studies suggest that participation in mathematical activities at home is related to children’s acquisition of mathematics in school (LeFevre, et al., 2009) and parents’ mathematics perceptions are important prerequisites in the development of young children’s mathematical skills (Kleemans, Peeters, Seggers, & Verhoeven, 2012). The crucial distinction is that, although instruction in mathematical skills not only occurs during purposefully selected mathematics activities, mathematics instruction is embedded in a real-world task (Hurst, 2008). However, the challenge is that while policymakers, researchers and educators decide how our children learn mathematics, parents do not seem to be anywhere in the discourse. Even though it is suggested that parents can and should play a greater role in their children’s math education. The problem is that most parents simply do not know how to assist their children learn mathematics (Chikodzi & Nyota, 2010). This situation is complicated by the fact that many parents had, in their younger days, struggled with mathematics themselves, making it more difficult for them to help their children and often resulting in their inadvertently passing on their own mathematics phobia (Bayanga, Mtose, & Quan-Baffour, 2010).

Against the background that the child is the reason for the connection between home and school, learners are the main actors in their education, development and success in school (Epstein,1996). The theory of overlapping responsibilities as advocated by Epstein (1996) suits this study, which investigates factors that influence parental involvement in the development of their children’s literacy at

secondary school level. The following section outlined the parent-educator partnership.

2.6. Parent-educator partnership

The term "partner" derives from the Latin word pars which refers to a "part" or "piece" of a whole (Al-Mahdi, 2009). A parent-educator partnership can be described as a dynamic process whereby parents and educators work together for the ultimate benefit of the child (Okeke, 2014). This involves collaboration on educational matters, goals, finding solutions, implementing and evaluating shared goals as well as inspiring and maintaining trust between parents and educators (Epstein, 2011b). Makgopa and Mokhele (2013) maintain that a partnership is a working relationship that is characterised by a shared sense of purpose, mutual respect and the willingness to negotiate. This implies a sharing of information, responsibility, skills, decision-making and accountability. Van Wyk and Lemmer (2007) say a parent-educator partnership is intended essentially to promote and support learners' learning, school performance and general well-being.

Okeke (2014) provides the following five aspects to explain the rationale for a harmonious parent-educator partnership:

- Parents are responsible by law for their children's education.
- If most of the child's education happens outside the school, especially in the home environment, and if parents are educators of the child with teachers, then it seems logical to make the two elements of school-education and home-education compatible.
- Research has found that family-based learning influences the effectiveness of the school on the child.
- Educators, as agents of formal education, have a responsibility to ensure that parents fulfil their duties.

In a democratic system, parents are major stakeholders and should be able to influence school policy through representatives.

While grandmothers-headed households have become prevalent in South Africa, public schools' personnel who have these students in their classrooms may not fully understand the dynamics of the family structure or how to involve and support it (Edward, 2006). Public school educator views may be influenced by their personal beliefs that the traditional stance that tend to consider families from disadvantaged backgrounds (e.g. working class, and low-income) as deficient (Moeller & Blelfelt, 2011). These traditional perspectives view the nuclear family with male providers and heads as normative. Thus, in these studies view deviations from the nuclear family were judged to be dysfunctional and pathological (Christianakis, 2011). Therefore, instead of adopting a deficit view of grandmothers raising their grandchildren, this study takes the stance that South African grandmothers serve a rich and valuable role in South African society. To better understand South African grandmothers who are caring for and improving upbringing to their grandchildren, it is important to understand the experiences and perception of these women.

A grandmother may find caring for her grandchildren rewarding but also challenging (Plaatjies, 2013). The interest of grandmothers in the educational system and school personnel, they become aware of changes that have happened since their own children were in school (Cherlin & Furtenberg Jr, 2009). The new responsibilities require grandmothers to navigate the system differently because of changes in the educational systems as well as their status as grandmothers rather than mothers (Moeller & Blelfelt, 2011).

As several researchers found, grandmothers raising their grandchildren can be perceived by some personnel as deficient family structure (Edward, 2006), some of the findings suggest that grandmothers are generally old, sicker and less physical active (Lunga, 2009). The finding from Christianakis (2011) suggest that some school personnel believe grandchildren being raised by grandmothers experienced school-related emotional behaviour distress to the degree that intervention should be considered. This does not mean that the behaviours are a result of being raised by

grandmothers but rather the result of the traumatic circumstances leading to the grandmother assuming the parental role (Mudavanhu, 2008).

Cherlin and Furtenberg Jr (2009) also examined perceptions of school personnel who interact with the family unit. The study suggested that children raised by grandmothers would likely occupy substantial amounts of school personnel time, further suggesting if teachers must spend much of their day focusing on the needs of these grandchildren, they will have less time to see the academic and behavioural needs of other students. School personnel need a clear sense of their own ethnic and cultural identities in order to understand these of their students and families (Moeller & Blelfelt, 2011). The danger of obtaining knowledge about specific cultures or family structures is it increases chance that school personnel will unintentionally act in inappropriate ways (ibid).

These perceptions and misrepresentations may keep school personnel from seeing grandmothers for who they are and not making assumptions based on what they think they know about their student's culture, families structure and language (Al-Mahdi, 2009). These challenges may create obstacles for grandmothers as they navigate the educational system and interact with schools. Exploring home base activities grandmothers engage their grade 2 grandchildren in may provide grade 2 teachers with insight of children's social capital they bring in class that can be incorporated in the teaching of mathematics.

In South Africa, the No Fee school policy, has eroded parental involvement practices amongst parents instead they varied and sporadic (Simkins & Spaull, 2013). For many school personnel, their lack of home knowledge and limited parental involvement become bias (Graue, & Hawkins, 2010). School personnel interpreted the lack of parental involvement as a sign they did not care about their children's education, instead of understanding the home and family structures children come in (Christianakis, 2011). From this standpoint, relationship with parents are limited to one-way flows of information, with parents needing understanding of the school of norms and practices of the school (Graue & Hawkins, 2010).

Many South African children do not perform well in mathematics (Feza, 2015). Curriculum prescripts have eroded family engagement and connections with school personnel has compromised (Moloi, 2006). The lack of understanding of the who are being integrated created a divorce between mathematics at home and mathematics at school (Tatira, Mutambara, & Chagwiza, 2012). Therefore, school personnel began teaching children with preconceived notions and stereotypic new nothing about their social capital.

Through the omission of multicultural understanding, schools have become monoculture environments (Christianakis, 2011). Monoculture can be defined as a practice of actively preserving a national culture via the exclusion of external influences (ibid). It can also mean a society with a common heritage, belief, structures, usually mono-racial identity; one that tends to look inward than outward.

The South African system of Education is built solidly on the monoculture, a Euro-Centric view, and it tend to benefit white and affluent students, whose cultural patterns and style are more attuned to this worldview (Moloi, 2006; Tatira, Mutambara, & Chagwiza, 2012). When looking at public school curriculum, the CAPS, one can see subtle and examples of this monoculture. Public school system disperses a curriculum centred on western civilization that encapsulate only a narrow the truth, reality, breadth of human experiences (Moloi, 2006).

The curriculum prescripts reinforce institutional divorce by excluding from discussions the intellectual thought, scholarship and history, culture, contributions and experiences of minority group (Yaro, 2015).

Grandmothers wish to support their grandchildren, but have different conceptions of what school personnel expect from them to do and how their involvement strategies may be perceived by schools. Many families limit themselves to the involvement as dictated by school personnel. Graue & Hawkins (2010) contended the lack of parental involvement is largely due to families' unfamiliarity with educational structures and the power of imbalance that traditionally exist in educational settings.

2.7. Grandmother-headed households

According to the South Africa Census Bureau (2011), increasing numbers of children in South Africa are living with their Grandparents, many of whom are responsible for their grandchildren's care and upbringing. The increase has been attributed to a variety of structural factors such as drug and alcohol problems, the rise of single-headed household, teen pregnancy, female incarceration, illness and physical health such as HIV/AIDS resulting in the death of a parent (Makalima, 2010). Fifty-three percent of the 5.3 million children living in grandparents reside with their grandmothers (Statistics South Africa, 2011). Thus, Grandmothers raising their grandchildren has become a common family structure in households (Duku, 2006).

In the majority of these cases, the primary caregiver has been identified as the grandmother. A surrogate parent is defined as one who stands in the place of a child's parent, but who is not that parent (Mudavanhu, 2008). A surrogate parent is an individual who acts in place of the legal parent to make decisions about the child when no parent can be located or identified (Schrijenis & Smit, 2014). The choice is either by virtue of voluntary or court-appointed status, that person assumes all rights, duties and responsibilities of the child's parent. In many of these families, grandmothers are raising grandchildren not by choice or tradition but by default. It may be where a family crisis necessitated that a grandparent is required to take the responsibility as parent (Makalima, 2010). Historically, grandmothers have often served voluntarily as an alternative and no obligation was attached to their role.

Historically, they have been the cornerstones in African learning institutions, throughout playing critical roles in the development of the family and of the church. These grandmothers have played pivotal roles in the stabilization and socialization of children and families for many years (Aubel, 2007). They have been nurturing figures and protectors, whose role responsibilities have stretched beyond their nuclear and extended families, well into the community as a whole. Cox (2007)'s depiction of these grandmothers, as the "guardians of generations" is a case in point. These grandmothers were often responsible for the survival of the families and as the elders imparted their wisdom, sense of ethnicity/ family unity, deeply rooted religious beliefs; and were self-sacrificing organizers of the community (ibid). They are further

portrayed as the communicators of family values; providing the religious orientation to family members" (Boyer, 2015).

The level of education the grandmother has or the degree of literacy may also directly impact on their grandchild mathematics education (Adams, 2010). If the grandmother is educated, he/she may be able to assist their grandchild with projects and other school work. If a grandparent is illiterate or never completed his/her schooling this may lead to frustration to both the grandparent and grandchild because no assistance with school work will be given (Plaatjies, 2013). Some grandchildren might be embarrassed by their grandmothers' lack of education and may not inform them of teacher-parent consultations (Lunga, 2009). Some grandmothers might not realize the importance of education because they have not received any formal education (Mansfield 2009: 15).

Furthermore, reports suggest that this household is often reported as being more dependent heavy and having low-socio economic status (Makalima, 2010). Studies suggest that grandmother-headed household are the "poorest of the poor" and are in need of various forms of intervention (Lunga, 2009). Indeed, it is likely that households headed by grandmothers encounter a variety of socio-economic hardships (Makalima, 2010). This is due to the loss of social connections as well as stress due grief and loss (Plaatjies, 2013). Depending on the age of the grandmother, these households may depend on a variety of income sources, including social security, retirement income and earnings. In some cases, in South Africa, the grandchildren residing with grandmothers earn child support grants. This enables the grandmothers to meet additional needs, including childcare needs of the household such as food, clothing and educational costs (Makalima, 2010). Therefore, poverty among grandmother-headed households relative to other female-headed households with children will depend upon the accessibility of various types of income (Makalima, 2010). Grandmothers as caregivers suffer enduring hardships and are often stressed emotionally in fulfilling their obligations.

Learners living in grandmother-headed households might have experienced traumatic lost. These learners may have lost or have been taken away from their parents. These learners are now living in a grandmother-headed household which

could differ from the households of their peers. Learners in Grade 2 are referred to as ‘primary school going age children’ they are undergoing physical and emotional changes (Mudavanhu, 2008). As school going children they have to deal with the demands of education. Schools are not only where learners receive an education but where they interact with their educators and peers. Schools could be regarded as communities with their own codes of conduct, rules and regulations. Schools are excellent platforms for preparation where learners are taught, both directly and indirectly, how to interact with society at large (Ishimaru, Barajas-Lopez, & Bang, 2015). Largely, in this instance a strong sense of identity and a feeling of belonging could be practiced and experienced by learners (Lunga, 2009). Schooling may, in some instances, also be a disheartening experience to learners from grandmother-headed families because they feel isolated, lacking a proper identity and coming from a home that is not recognized by their peers or the school personnel (Makalima, 2010).

The following are some of the role played by grandmothers.

2.7.1. Grandmother as caregivers

Caregiver is defined as one who stands in the place of a child’s parent, but who is not that parent (Mudavanhu, 2008). This definition is supported by (Schrijenis & Smit, 2014) who refers to a caregiver is an individual who acts in place of the legal parent to make decisions about the child when no parent can be located or identified. Grandmother caregivers have been identified as a major strength of South African families (Duku, 2006). Historically, grandmothers have been described as guardian of the next generation (Aubel, 2007), the preserver of extended families, the keeper and share history, folk and beliefs, the source and communicator of values and ideas (Boyer, 2015), the protector of grandchildren (Cherlin & Furtenberg Jr, 2009). While South African grandmothers may find the role necessary for survival of the family, it may come with challenging experiences while they are caring for their school-going children (Plaatjies, 2013).

Caregivers' behaviours provide the foundations for nurturing the children’s growth (Minkler & Roe, 1993). For example, talking and listening to children is one way that

children can learn turn-taking required in communication. Caregivers can nurture mathematics when they count through cooking, mimic and walk with children and such activities lead to happy rote-learning and counting by young children (Anderson A., 2007). As caregivers engage in math related talk as they cook for example caregivers should model the book behaviour, for example taking one item and taking four teaspoons, reading page numbers as turning and top-to-bottom of page (Anderson, Anderson, Friedrich, & Kim, 2010). Brosnan & Hartong (2011) also share the same view that children's knowledge of nursery rhymes and their awareness of rhyme can be later reading and mathematics.

The roles of caregivers involve encouraging the use of correct language of mathematics to facilitate the growth of number concept but the single most influential activity for the caregiver is counting aloud with and to children (Benigno & Ellis, 2008). This develops print awareness and also fosters feelings of love towards mathematics(ibid). The sharing of print in a loving manner creates an emotional bond and facilitates successful formal and informal mathematics experiences (Esmonde, Blair, & Goldman, 2011). The afore mentioned roles are played by caregivers in the absence of parents. In a family situation parents should also play and support these roles. This is paramount in that parents have a major role to play in mathematics development of the child.

Caregivers as providers of basic mathematics assure that children have time, space, materials, encouragement and no-risk environment in which to work (Dehaena & Brannon, 2011). They say that caregivers should demonstrate love for mathematics themselves so that children perceive the value placed upon counting and writing mathematic related activities in their daily lives. They further recommend that caregivers should stay alert to changes in children's needs and behaviours and consider change in plans (ibid).

Findings from Aubel (2007) study asserted that "when an older takes on the kinship care, he/she is instantly placed into an unfamiliar new world of agencies, schools, legal systems, and policies and procedures". Nonetheless, these systems are critical to the care and education of the child; even though it could add additional stressors to the grandmother as second time parent. Parental involvement is a critical factor in

children's school achievement at all grade levels (Mudavanhu, 2008). Families need to provide for the physical, social, cultural, intellectual and emotional support so that children could function well in school (Lunga, 2009). Although the grandmothers may not have legal custody over their grandchildren, it is still expected that the grandchildren in their care receive holistic parenting and that the grandmothers should be held responsible for their holistic well-being. The above discourses suggest that majority of primary school age children live in grandmother-headed families and depend on their grandmothers and teachers for educational support. But some of these grandmothers are not able to fulfil every sphere of these primary school age children due to numerous challenges that face grandmother-headed families (Lunga, 2009). The teachers are also expected to provide support to these learners, although they also confront some challenges. At the end all these challenges affect the academic performance of these children (Plaatjies, 2013).

Notwithstanding of all these results, Schrijenis & Smit, (2014) allude to grandmothers as the most appropriate care givers for children whose parents had died or were unable to provide care. In addition, they also described grandmothers as being experienced in raising children and are believed to share in equal measure the parents" interest and affection" for children.

2.7.2. Grandmother as home-based teachers

A grandmother, as a parent, of the grandchild becomes the primary educator of that child. The grandchild learns valuable life lessons from their grandmother. Parental involvement has shown to be of paramount importance for the school career of the learner (Hyde, Else-Quest, Alibali, Knuth, & Romberg, 2007). Grandmothers might not be aware that their involvement in their grandchildren' mathematics education is vital. Despite the grandmothers' school involvement, they are also responsible to be a breadwinner, provide clothing, shelter and medical care. It is still expected of them to educate and transfer cultural norms and traditions to the younger generations, to instil a sense of cultural pride in their grandchildren (Aubel, 2007). It is also expected from them to understand their grandchildren's emotional needs, and physical changes and to help them cope with traumatic life experiences (Mudavanhu, 2008).

Research conducted by Jordan, Kaplan, & Ramineni (2009) throws light on the marked extent to which family members engaged with their children's learning at home in a range of practices. It is apparent that form of engagement reflects aspects pragmatism theory, particularly the collaborative nature of learning and the role played by parents (grandmothers) in scaffolding children's mathematical understanding.

Another important factor highlighted by Jordan, Kaplan, & Ramineni (2009) and (Feiler, 2010) was that the likelihood that such patterns of engagement may well not be evident to teachers, as they tend to occur out of school. Literature suggest that grandmothers view themselves as coach and or mentors to the children's mathematics education. According to Starcevich (1998) "a mentor is like a sounding board, they can give advice but partners is free to pick and choose what they do. A coach rather is trying to direct a person to some end results, the person may choose how to get there, but the coach is strategically assessing and monitoring the progress and giving advice for effectiveness and efficiency". Mentoring is biased in your favour, whilst coaching is impartial, focused on improvement in behaviour.

In summary, the mentor has deep personal interest, personally involved, a friend who cares about you and your long term development. The coach develops specific skills for task, challenges and performance expectations at work. Mentoring is a power free, two-way mutually beneficial relationship. Mentors are facilitators and teachers allowing partners to discover their own direction.

It should be understood that moving in with grandmothers might not have been a smooth transition to some of these grandchildren. Some of these grandchildren might have been abused and neglected; it now becomes the responsibility of the grandparents/s to seek professional help for them and during this process to guide and support their grandchildren (Mkhonta 2008: 88).

The following chapter focuses on research methodology used in the study.

Chapter 3

Research methods and Methodology

3.1. Introduction

The aim of this chapter was to outline the research methodology and methods used in this study, the rationale behind choosing them and the limitations involved. Qualitative research method was used in this study to gather, record and analyse data. Research paradigm, research design as well as data collection methods appropriate for this study were explained. Case study design was used to unpack home activities grandmothers engage their grandchildren to promote Grade2 Foundation Phase learners' mathematical skills. Shadowing analysis was also conducted to explore grandmothers' home practice that may promote their grandchildren's Foundation Phase mathematical skills. Furthermore, the chapter provided a clear description of the sampling techniques, sample size, as well as ethical considerations employed as the blueprint for the data collection and its analysis to ensure the achievement of the research objectives

3.2. Research paradigms: Interpretative paradigm

The concept 'paradigm' is defined by various writers according to their specific context since there is no single cut and dried definition of it. Cohen, Manion, and Morrison (2007) viewed 'paradigm' or 'world view' as the perspective that provides a rationale for the research and commits the researcher to particular methods of data collection, observation and interpretation. Following from the nature of the research problem and research questions, the study was guided by the interpretive paradigm.

An interpretive paradigm is a research culture with a set of beliefs, values, and assumptions that a community of researchers has in common regarding the nature and conduct of research (Creswell, 2010). This implies that a paradigm is a pattern, structure and framework or system of scientific and academic ideas, values and assumptions. Similarly, Lincon and Guba (2006) described a paradigm as a systematic set of beliefs and methods that provide a view of the nature of reality.

Leedy and Ormrod (2013) concurred and defined research paradigm as a world view, a general perspective and a way of breaking down the complexity of the real world. It is concerned with the arrangement of conditions of collecting data and analysing the data aiming at combining relevance to the research study. Lithtman (2010) pointed out that a paradigm is a theoretical model within which the research is being conducted, and organizes the researchers' view of reality (though they may not be aware of it). The following were identified by Packer (2011) as the functions of the research paradigm: it defines knowledge of how the world works, how knowledge is extracted from the world and how one is to think, write and talk about his knowledge. It also defines the types of questions to be asked and the methodology to be used in answering, what is to be published and what is not, as well as the meaning and the significance of the research findings. Therefore, a research paradigm is the overall plan for the research study. Creswell (2010) opined that there is a need to adopt a paradigm for an academic research because it is an encircling system of unified practices and values that outline for the researcher the nature of their inquest. Hence, this study is located within the interpretive paradigm.

An interpretive paradigm as noted by Lithtman (2010), is based on the notion that researchers use constructs such as culture, social context and language to build their view of the world and that social reality is shaped through social interactions. An interpretive paradigm also provides an opportunity for the voice, concerns and practices of research participants (Bryma, 2012). This paradigm befitted this study as the study focused on the home activities grandmothers engage their grandchildren in to promote Grade 2 mathematical skills. What people know is always negotiated within cultures, social settings and relationships with other people. Creswell (2010) goes on to say that interpretive researchers reflect an interest in contextual meaning, rather than generalized rules, instead of surveying large groups, qualitative research focuses on small groups, hence this study is interested on what grandmothers do with their grandchildren that may be used to promote mathematical skills of Grade 2 Foundation Phase learners. Furthermore, Rule and Vaughn (2011) attests to the interpretive paradigm as an attempt to understand individual interpretations of the world around them.

Packer (2011) noted the following as premises for the interpretative paradigm: people make decisions and act in accordance with their subjective understanding of the situations in which they find themselves; people's actions are based on their interpretations in which the relevant situations are taken into account; and social life consists of interaction processes rather than structures and, therefore, constantly changes. Based on these premises referred to above, I therefore found an interpretivist paradigm relevant for this study as I sought to explore in depth the practices and perceptions of grandmothers regarding their involvement or lack thereof in the promotion of their Grade 2 grandchildren's mathematical skills. Individual views are, therefore, considered significant and of value in this study. I depended on their background and experiences to get the rich data (Creswell, 2010; Neuman, 2008). I engaged on one on one in-depth interviews with the grandmothers and Grade 2 teachers while exploring the practices and perceptions of grandmothers regarding their involvement or lack thereof in the promotion of their grandchildren's mathematical skills, so as to gain a better understanding of their perception, experiences and live reality. Furthermore, shadowing was also undertaken to closely follow the families and to take note of what they do, what they commonly talk about and the interactions between the grade 2 child and grandmothers and other family members. The next section explores the research approaches used in this study.

3.3. Research approach: qualitative

On the basis of the paradigm given above the study followed a qualitative research approach. MacMillan & Schumacher (2010) defined qualitative research as a systematic research approach that seeks to collect rich descriptive data on a particular phenomenon with the primarily concern to understand the social actions, beliefs, practices and perceptions. In studying home activities grandmothers do, it is their stories and practice of what they do and the meanings ascribed to those stories that I was particularly interested in. The essence of this has been captured through pragmatism theory of (Dewey, 1931).

Qualitative researchers investigate the how and why of decision making not just the what, where, and when Creswell (2010), hence, qualitative research's focus on smaller samples. Creswell further went on to say that qualitative research provides illumination and understanding of complex psychosocial issues which are most useful for answering humanistic 'why?' and 'how?' questions.

This indicates that qualitative research is inherently multi-method in focus. In other words, qualitative research consists of an investigation that:

- Seeks answers to a question;
- systematically uses a pre-determined set of procedures to answer the question; collects evidence;
- produces findings that were not determined in advance; and
- produces findings that are applicable beyond the immediate boundaries of the study.

To address the research questions of this study, I decided on using qualitative research approach. The primary goal of qualitative interviewing is to seek out what is on another person's mind Bryman (2012). The following are the advantages of a qualitative approach, as stated by Lihtman (2010) it produces more in-depth, comprehensive information and also seeks an understanding of the entire situation. Thus, it enables qualitative researchers to capture the richness of the data as it involves an in-depth understanding of human behaviour and the motives that govern the behaviour. Glesne (2015) further noted that the strength of qualitative research is its ability to provide complex textual descriptions of how people experience a given research issue. It also provides information about the "human" side of an issue, that is, the often, contradictory behaviours, beliefs, opinions and relationships of individuals. In this study, the qualitative approach was appropriate because I wanted to discover what home practices grandmothers' do and how they link with Grade 2 mathematical skills as well as the interactions between Grade 2 teachers and grandmothers to promote children's mathematics education. This was done through asking questions that sought to solicit how Grade 2 teachers and

grandmothers sought to promote children's' mathematics education. I used semi-structured / open-ended interviews to provoke the data from the grandmothers and teachers as well as shadowing and snowballing to triangulate. The interaction with the participants enabled me to gain valuable data that is useful in understanding their circumstances and perceptions regarding what home activities grandmothers engage their grandchildren to promote mathematical skills of Grade 2 foundation phase learners.

Qualitative research methods were more suited to improving the understanding of human behaviour and practices, especially in more complex systems of life integrated processes such as the learning of mathematics (McMillan & Schumacher, 2010). It is through this research approach that I have attempted to understand specifically what home practices grandmothers engage in and how they link with Grade 2 mathematical skills as well as the interactions between Grade 2 teachers and grandmothers to promote children's mathematics education. This research methodology allowed me to understand the processes involved in grandmother-headed households and the social context within which the particular beliefs, attitudes and practices of grandmothers were developed. Qualitative methods were therefore, suitable in this study for addressing the main question of the study, being: what home activities grandmothers engage their grandchildren to promote mathematical skills of Grade 2 foundation phase learners? The study followed the case study design to collect data.

3.4. Research design: case study

Since the study was interpretive, the most appropriate research design needed to gather data was the case study. Lapan, Quartaroli and Riemer (2011) and Bryman (2012) defined the research design as a blueprint or outline for conducting the research study in such a way that maximum control is exercised over factors that could interfere with the validity of the research results. However, Leedy and Ormrod, (2013) concur and define a research design as a strategy that moves from an underlying philosophical assumption to specifying the selection of respondents, the data gathering techniques and data analysis used to obtain answers to the research questions guiding the study. This, therefore, helps researchers to plan and

implement the study in a way that would help them to obtain the intended results, thus increasing the chances of obtaining information that could be associated with the real situation.

In other words, research design can be seen as the logical plan or master plan of a research that throws light on how the study is conducted. It shows how all of the major parts of the research study, such as the samples or groups, measures, treatments or programs, work together in an attempt to address the research questions. Research design is similar to an architectural outline. In line with the qualitative research method, this study followed a case study design. Rule and Vaughn (2011) believes that a case study is an in-depth investigation into a specific and relatively small area of interest. Glesne (2015) concurs with Barbbie and Mouton (2007) that a case study is a method that allows the individuality of each case to come out as a persuasive voice.

As has been indicated earlier, this study was a case study. In line with the above argument, Creswell (2010) also believed that a case study is an in-depth investigation into a specific and relatively small area of interest. Leedy & Ormrod (2013) concur with Creswell that a case study is a method that allows the individuality of each case to come out as a persuasive voice. Furthermore, Cohen, Manion, & Morrison (2007) also state that a case study is an approach that uses in-depth investigation of one or more examples of a current social phenomenon. As a result of their robustness, case studies combine data collection methods such as archives, interviews, questionnaires and observation (MacMillan & Schumacher, 2010).

In support of this, Cohen, Manion & Morrison (2007) view a case study as a process by which a researcher observes, describes, explains and views the operations and functionality of an individual person, an event, or social activity, or group of cases." According to these authors, it is an approach that uses in-depth investigation of one or more examples of a current social phenomenon in its natural setting. This involves collection of detailed data that are rich in content and involves multiple sources of information such as interviews, snowballing and shadowing from the research participants' viewpoint (emic perspective). Cohen et al. (2007) state that a

case can be an individual person, an event, or social activity, group or institution. The case in this study were six grandmother-headed households in the community with each family as a unit of analysis contributing to the broader case.

Literature reviewed in chapter two revealed that the role of home in promoting children's mathematical skills had been undertaken by various researchers. The case study design in this study, therefore, gave an in-depth detail on home-based activities that promote Grade 2 Foundation Phase leaners' mathematical skills. I also believe that the findings of this study will play a role by encouraging grandmothers living with Foundation Phase learners to be more involved in their grandchildren's mathematics education.

In this study, the case was bounded by grandmothers who were the primary care givers of grandchildren who were also Grade 2 Foundation Phase learners in the rural, township, and urban metropolitan areas of East London Education District in East London. However, it is worth specifying that the study is a case of six grandmother-headed households in the community with each family as a unit of analysis contributing to the broader case. The choice of a case study as the research design for this study was inspired by Creswell (2010), who described a case study as a design that examines a bounded system, or a case, over time, which employs multiple sources of data found in the setting (Macmillan and Schumacher, 2010). Furthermore, the choice of case study was inspired by other case research into parent mediation of children's mathematical learning. For instance, Esmonde, Blair, & Goldman (2011) employed a case study of parents from culturally diverse metropolitan areas within British Columbia, Canada. Moreover, other case studies into parent-child interactions Leedy & Ormrod, (2013) often in clinical context, indicate that parents support their children's mathematics learning, notwithstanding parents' educational and socio economic background. The context in which parents do so, influences mathematics support they give to their children at home (Anderson, 2007).

I used the case study design to get in-depth information about the nature of home-based activities grandmothers engage their grandchildren to promote mathematical skills of Grade 2 Foundation Phase leaners. This design revealed certain aspects of

grandmothers' perception of their role and attitudes that influence their involvement in the promotion of their grandchildren's mathematical skills. Some of the research sites (Grand mothers') were not easily accessible. Sometimes the researcher would visit the site and only get no one to interview despite our agreed upon time. It was during this stage that the researcher decided to do shadowing for two days in each household in order get to interview grandmothers. At the end, the researcher managed to interview all the six grandmothers. As Rule and Vaughn (2011) assert, a case study design allows for the collection and presentation of detailed information about a particular participant or small group of participants (ibid). The case study design enabled me to work much closer with a limited number of participants and delve deeper to unravel ways by which grandmothers raising their grandchildren in rural, township and urban community, promote their grandchildren's mathematics skills.

Leedy and Ormrod (2013) identify and explain three main characteristics of case studies: particularistic, descriptive, and heuristic. Particularistic means that a case study focuses on a particular situation, event, programme, or phenomenon. The case itself was important for what it revealed about the phenomenon and what it might represent. Descriptive signifies that the end product of a case study is rich, "thick" description of the phenomenon under exploration, while heuristic indicates that the case study illuminates the readers' understanding of the given phenomenon (Miles, Huberman, & Saldan, 2014). It can bring about the discovery of new meaning, extend the readers' experience, or confirm what is known. Therefore, in spite of limited sample size of this study, a case of six grandmother-headed households has provided for "thick descriptions" of data. Case studies are, therefore, not representative. They are often selected to extensively explore particular issues, especially when it would have been difficult to separate the variables involved in the phenomenon under study.

On the contrary, case studies in general do, however, have some measure of weakness areas. A case study is prone to problems of observer bias, especially if it relies on an individual's memory since it is not easily open to cross-checking (Neuman, 2008). Also, the results obtained from a case-study cannot be generalized, except where other researchers see their application (Nisbet & Watt as

cited in Cohen et al., 2007). To counteract these possibilities, I remained vigilant in terms of choosing knowledgeable respondents and appropriate instruments so as to obtain data which captures the meaning of what the study is all about. In line with the protocols of a case study design, a combination of methods was used as follows:

i. Snowballing

ii. Shadowing

iii. Semi-structured interviews

The main aim of the study, however, is not to generalize the results of the study to the entire population of Eastern Cape or to all grandmothers that participated in the study. The main aim is to develop the understanding of what home mathematics related activities grandmothers do and what do they mean to them and further, to investigate possible link between home activities and Grade 2 mathematical skills. Thus, the grandmothers' stories can be told, and will be heard. The next section deals with data collection instruments.

3.5. Data Collection Methods

A number of suitable data collection methods were used in this study. The data collection plan divulges sources of data and the role played by the researcher during data collection procedures. Creswell (2010) proposes that data collection plan comprises the sequential steps taken in the collection of data. The plan is of utmost importance since it enables the researcher to organize the logistics and the procedures to be undertaken in collecting data overtime. The study made use of shadowing and, interviews (semi-structured interviews) as its data collection techniques (Miles, Huberman, & Saldan, 2014). The interviews were the prime source of data collection in this study. For data collection, I started by conducting shadowing, and finally conducted semi structured interviews. These techniques followed this sequence so that whatever was observed and discovered during the analysis of documents is cleared during the one on one interviews. All the two aimed at accessing data on the home activities grandmothers engage their Grade 2 grandchildren to promote Foundation Phase mathematical skills.

This study was based on interviews of both grandmothers and Grade 2 teachers. I sought to hear narrative accounts of mathematics in grandmother-headed households' daily life that can be used to promote Grade 2 mathematics skills. The total number of respondents interviewed was nine, inclusive of six grandmothers, and three Grade 2 teachers. The families represented the spectrum of Black Africans with diverse socio-economic status and with educational levels ranging from high school education to university graduate level. All of the GHHs included at least one Grade 2 learner at the time of shadowing GHHs and I was interested in how Grade 2 learners at this crucial juncture were experiencing mathematics at school and at home. For the exploration of the central phenomenon of this research, "what home activities grandmothers engage their grandchildren to promote mathematical skills of Grade 2 Foundation Phase learners, and how do home activities link with Grade 2 mathematics", semi-structured interviews using anonymous interview design with open-ended questions and shadowing were deemed most appropriate for this study.

3.5.1. Shadowing

Shadowing data collection method involves a researcher closely following a member of an organisation over an extended period of time (Quinlan, 2008:1482). McDonald explained that when the person being shadowed goes to another department, the researcher follows them; when they have a project meeting or meet with a customer, the researcher sits in; if they have coffee with friends who are colleagues from another site, the researcher goes too (2009). For this study, shadowing allowed me to closely follow and investigate grandmothers on what they do with their grandchildren over a period of time to in the course of their everyday lives, not what their roles dictate of them (see Appendix C). I shadowed the grandmothers and their grandchildren from the moment they begin the day until the end of the day. This included hours of stationary observation whilst the person being shadowed was cooking or planning, running between buildings or attending church or doing shopping with their grandchildren.

Gill, Barbour, & Dean (2014) asserted that shadowing can be done over consecutive or non-consecutive days for anything from a single day or shift, up to a whole month. Furthermore, McDonald (2009) showed that studies focus on a single role (such as

new recruit or purchasing manager) in several companies or on a number of roles within the same company. In this study, shadowing was done over a single day for each grandmother-headed household and the focus was on a “single role” of grandmothers’ participation in their grandchildren’s’ mathematics education”. Throughout shadowing period, I asked frequent questions which prompted a running commentary from grandmothers’ actions and choices. Some of the questions were for clarification, whilst other questions were intended to reveal purpose.

3.5.1.1. Conducting shadowing

Shadowing was the first data collection method used in this study. During the shadowing, I wrote an almost continuous set of field notes. I recorded participants in, and times and contents of, conversations. I wrote down the answers to the questions I have asked and as much of the running commentary as is possible. I take further guidance from Gill, Barbour, & Dean (2014) who asserted that when shadowing one has to note the body language and moods of the person they are shadowing. I, therefore, noted the body language and moods of grandmothers and their grandchildren as they moved throughout their everyday activities. At the end of the shadowing period, I gained a rich, dense and comprehensive data set which gives a detailed, first hand and multidimensional picture of the role, approach, philosophy and tasks of the person being studied.

For the exploration of the research topic, grandmother-headed household were shadowed on the following: Out of household shadowing-interactions and relationships amongst grandmothers’, grandchildren and household learners/ what activities do they do together/beliefs/ household traditions/ environment that influences mathematics learning/ printing material within the household/ travelling activities/ family events/ grandmothers and other siblings attitude in relation to mathematics/ negative and positive discussion - who says what/ cliques and groupings/ common discussion amongst the household/ relationships with grandmother-community-etc. /improvements and family development - who initiates - who gets involved//state/ upkeep and utilization of the household environment and the infrastructure movement patterns of grandmothers’ other siblings/ when family gets together/what do they like to talk about/ what do grandchildren talk about. The

data collected from shadowing and interviews provided me with more detailed qualitative data used to develop the case studies, which are described in Chapter 4.

3.5.2. Interviews

Interviews, as defined by Creswell (2014), refer to a two-way conversation between the interviewer and the interviewee which can be used to gain information, ideas, beliefs, views and opinions about the phenomenon under study. Interviews can be structured, unstructured and semi-structured. Structured interviews can be defined as a professional discussion between two persons or one person and a group of persons (Bryman, 2012). The advantages of this method were that the interactions and behaviour of the interviewee can be observed and results can be noted. It can also be used to lessen tension between the individual and the researcher and even motivate the subject to participate in the research. This choice was based on the following Bryman (2012) considerations:

- The semi-structured design gives the participants ample time and scope to express their diverse views and allows the researcher to react to and follow up on emerging ideas and unfolding events (Bryman, 2012).

- Results obtained through semi-structured interviews can be compared among each other since all participants are required to express their views about the same general themes (ibid).

- Semi-structured interviews allow not only for assessing the participants' opinions, statements and convictions, they also allow to elicit narratives about their personal experiences (ibid).

- Open-ended questions allow the participants to freely voice their experiences and minimize the influence of the researcher's attitudes and previous findings (Creswell 2010).

- Anonymity was guaranteed in order to give the participants the opportunity to freely express their views and encourage them to also address politically delicate issues (Sotuku & Duku, 2015).

Leedy and Ormrod (2013) noted that the use of open-ended questions and probing give participants an opportunity to respond in their own words, rather than forcing them to choose from fixed responses as quantitative methods do. Open-ended questions have the ability to evoke responses that are:

- meaningful and culturally salient to the participant;
- unanticipated by the research; and
- rich and explanatory (ibid).

I used semi structured interviews (see Appendix C) to be able to obtain information on how individuals (grandmother and teachers) perceive their own world and how they explain or make sense of the important events and practices in their lives (MacMillan & Schumacher, 2010).

The semi-structured interview method made it free to intervene and seek "clarification or further explanation" Yin (2003) from the participants for a better understanding of their descriptions of the home activities they engage their Grade 2 grandchildren to promote mathematical skills. During the process of interviews, I was able to ask probing questions as the conversation developed repeat or rephrase questions to ensure that all the areas of interest to the study are covered. According to Bryman (2012), probes are used to deepen the response to a question, increase the richness and depth of responses, and give clues to the interviewee about the level of response that is desired. On the contrary, Glesne (2015) warns that excessive use of probing questions makes the respondents feel intruded upon, thereby, diminishing the likelihood and the willingness to entering into a deeper exploration of the issues. I used probing questions when there was an indication that the respondent has become comfortable with the interview situation, thus not to threaten respondents with too many probing questions and thereby blocking the easy flow in answering questions. These interviews provided me with the first-hand information as a way of enhancing the credibility, trustworthiness and the conclusions that can be drawn from the study (Lincoln & Guba, 2006). These semi structured interviews were conducted with grandmothers and Grade 2 Foundation Phase teachers.

In semi structured interviews it was essential to develop in advance an interview schedule. According to Lithtman (2010), an interview schedule is the instrument which contains a list of key topics and perhaps subtopics framed in question form to ensure that the right questions are asked with regard to the study. These questions were guided by the research questions of this study so as to meet the objectives of the study. In this study, the principles of a good interview schedule were followed closely, as suggested by (Neuman, 2008). This enhanced the quality of my instrument because I ensured that:

- the questions were clearly worded and unambiguous, so the teachers have no difficulty in understanding them;

- the questions were not double-barrelled, that is, no two or more questions joined together to create confusion for the respondents;

- most of the questions were open-ended to allow for flexibility and probing in more depth; and

- the questions were not sensitive or personal and have no double negatives to restrict willingness and understanding from the respondents.

Despite the principles I followed, Niewenhuis (2008) made it clear that “No matter what style of interviewing is used, and no matter how carefully one words interview questions, it all comes to naught if the interviewer fails to capture the actual words of the person being interviewed.” Based on this I used a combination of voice recordings and note-taking (field notes) to record the data during the interviews. The use of a voice recorder was decided upon by the individual respondents. Lithtman (2010) suggests that even though voice recorder use in interviews aids in making the documentation of data independent, it must be done after at least the first five minutes of the interview in order not to make respondents edgy, and to create a relaxed atmosphere. This advice was followed to ensure that all respondents were relaxed.

As part of my note taking, I made use of direct observation while listening attentively as the interviews were unfolding, by looking for changes in body language including

laughter, hand movements, eye contractions, gestures, tone of voice, facial expressions, and so on. These observations were found necessary because they helped me to harness some of the contextual factors that are not verbalized. This strategy of note-taking was done in a manner that did not obstruct the process of the interview; hence this form of observation took place in a natural and normal way, according to Bryman (2012) advice. However, since in a qualitative study the researcher serves as a data collection instrument, I was aware of problems associated with the interview, in general, and the semi-structured interview, in particular, in order not to take them for granted. It is argued that the construction of an interview schedule may be biased by the interviewer's view of the world (Bryman, 2012) and that transcribing from words to text will inevitably lose data from the original live interview situation; hence there is a potential for distortion and the reduction of complexity.

To overcome these forms of bias and distortion, I followed the recommendation that the interview must not be analysed for content only but must also include some aspect of discourse analysis (act to show how certain discourse is deployed to achieve certain effects) so that possible hidden meanings created during the interview could be highlighted (Bryman, 2012). Based on this, I made every effort in formulating the interview questions to keep them as objective as possible and I carefully analysed data to limit bias which can influence the study. The next session will deal with how interviews were administered.

3.5.2.1. Conducting Interviews

Grandmother-Headed Household

The family stories were collected earlier in the interviews, and were meant to be ice-breakers that allowed family members to talk about mathematics in their lives before our interview prompted them to talk about specific family context and activities. I asked for a story involving mathematics, good or bad, from any setting, including school, work, and home, that would take few minutes to tell. The task enabled each family member to relate to mathematics in his or her own way. The stories covered all kinds of territory, from how grandmothers felt about mathematics in the home

environment, to how they felt when they failed mathematics, to how they used mathematics while fixing something around the house.

To help interviewees understand the task, I began by telling an example story that did not involve school mathematics. My story undoubtedly influenced some of the participants' stories, perhaps by eliciting many non-school mathematics stories (as intended). Likewise, grandmothers followed on my story through association they made with them, but generally, my story was not out of the common range for mathematics-relevant. Each household told a different story about a recent experience. For example, one grandmother participant discussed helping their neighbours lay laminate flooring and the mathematical challenges involved in the project.

The other strategy that was used to collect data from grandmother-headed households was shadowing. As Glesne (2015) asserts, it is important to gain an in-depth contextual detail of the purpose of the phenomenon studied. I collected data through shadowing to assist me in gaining greater insight and more detailed information about home activities to promote mathematical skills.

Primary Schools

I opened the interview by introducing myself and explaining the purpose of the study. I then explained to the interviewees that this was son voluntary basis and that they have a right to withdraw anytime should they feel to do so. I further insurer them that their responses will be kept confidential and their names will not be revealed. This helped the process as all interviewees were at ease to answer the questions. All interview slots were schedule for after school as these were the Foundation Phase teachers who are the teacher the only teachers in their classroom. The interviews lasted for about 30-45 minutes

3.6. Sampling procedure

Sampling must be done whenever one can gather information from only a fraction of the population of a group or a phenomenon which one wants to study. Ideally, one should try to select a sample which is free from bias (Greenfield, 2002; Johnson &

Christensen, 2008; Gay, 2008). Leedy and Ormrod (2005) argue that qualitative researchers tend to select a few participants who can best shed light on the phenomenon under investigation, rather than sample a large number of people with the intent of making generalizations. In addition, Creswell noted that in qualitative research, “the intent is not to generalize to a population, but to develop an in-depth exploration of a central phenomenon”, which is best achieved by using purposeful sampling strategies (2010:203). Furthermore, Creswell notes that sampling involves selecting a unit of analysis (people, groups, artefacts, settings) of a population for investigation in which the researcher is interested (2010:79). In other words, sampling is made for the explicit purpose of obtaining the best possible source of information to answer the research questions. In this study, I used snowball and purposive sampling to identify a particular group of grandmothers that participated in this study.

3.6.1. Snowballing

In a qualitative research, snowballing is a type of sampling. In this method, participants or informants with whom contact had already been established, made use of their social networks to refer the research to other people that could potentially participate in or contribute to the study. Snowballing sampling is often used to find and recruit hidden populations, that is, groups not easily accessible to researchers (Gill, Barbour, & Dean, 2014). Mutendwahothe (2011) maintains that snowball sampling is a special non probability method used when the desired sample characteristic is rare. Furthermore, Glesne (2015) asserts that snowball sampling can be used to identify experts in a certain field. In my case, this identification was in Grandmothers who head households and raising Grade 2 learners.

Potential research participants often want to identify a common person that both the participant and researcher know in order “to check the researcher’s credibility and trustworthiness (Liamputtong, 2008). Often, researchers gain access to their potential participants through acquaintances and friends. In this study, when I got the first contact it began a chain or snowball effect. The first respondent – a grandmother who worked as a general worker recommended me to her colleagues

from the same company and acquaintances from other grandmothers who were coming from diverse areas of the East London Education District. They, in turn, advised me of other grandmothers they know. Mutendwahothe (2011) argued that there are positive and negative sides with this approach. The positive side is that it helped me to develop important links within the East London Grandmother-headed household sphere. With any hard-to-reach group this snowballing technique seems to be appropriate as it facilitates new and relevant contacts for the researcher (Liamputtong, 2008).

In this way, snowballing is a “door opener” to “non-elite” in my case. It helps not just to save time and effort, but is a good tool to collect relevant data needed for input into the study (Glesne, 2015). The snowballing technique was indispensable for me, because, without further recommendations, I would have had more problems with accessing interviewees. As a result, I conducted six interviews with them and then shadowed each household.

Since the researcher could not interview the whole of this population, a representative sample had to be obtained. The study also used purposive sampling which is a form of selecting purposefully to permit inquiry into and understanding of a phenomenon in depth (Mutendwahothe, 2011). The following section describes purposive sampling.

3.6.2. Purposive Sampling

Purposive sampling is defined by Creswell (2010) as a sampling approach whereby participants are selected because of the data they hold, or represent for the study and thus the sampling decisions are made the explicit purpose of obtaining the richest possible source of information to answer the research questions. With purposive sampling the researcher recognises that there may be inherent variation in the population of interest (Mutendwahothe, 2011). The researcher attempts to control this by using subjective judgement to select a sample that the researcher believes to be a representative of the population. Purposive sampling can lead to very good samples, but there is no guarantee that it will be successful (ibid). Its success depends on two assumptions:

- the research can identify in advance the characteristics that collectively capture all variation.

- the chosen sample will correctly reflect the distribution of these characteristics (Mutendwahothe, 2011).

For this study, I needed participants' grandmothers, who are primary care givers of Grade 2 learners and also household heads in order to broaden my exposure to different home activities to promote mathematical skills of Grade 2 Foundation Phase learners. Further, I needed participants who had a complete experience of teaching Grade 2 learners in rural, township and urban areas. The purposive sampling is supported by Glesne' s (2015) claim that "Many qualitative researchers employ purposive and random sampling methods as they seek out groups, settings and individuals where processes being studied are most likely to occur." I take further guidance from McMillan and Schumacher (2010) who assert that, in purposive sampling, the researcher selects particular elements from the population that will be representative or informative about the topic of interest, on the basis of the researcher's knowledge of a population; a judgment is made about which subjects should be selected to provide the best information to address the purpose of the research. In this study, I therefore purposefully selected participants; six Grandmother-headed households purposely selected in East London, rural, township and urban in the East London Education District.

In constructing my sampling frame, I then considered, first and foremost, the purpose of the study: the choice of six grandmothers was based on the fact that I wanted to conduct a case study that would be descriptive and exploratory. From the literature I have surveyed (in Chapter Two), the present study is in many ways unfamiliar in South Africa. Not many researchers have explored and written about grandmothers' participation in the manner that I do, in particular from the resource based perspective/ approach. As an exploratory study, I did not need too many participants that could overwhelm the study. Ideally, a qualitative research study involves just a few respondents so that a phenomenon can easily be understood and described (Glesne, 2015). For the purpose of this study, sampling was done in two levels, namely:

- Sampling the research site
- Sampling the respondents

3.6.3. Sampling the research site

For this study six GHHs were selected, two from the rural, township and urban area with high rates of illiteracy, unemployment and poverty and the other two from the township and urban area with high rates of unemployment, poverty and drug abuse. The researcher had chosen these research sites because she has witnessed the prevalence of school going children residing with their grandmothers. The purpose of this study is to explore the contribution of grandmothers in improving academic achievement of mathematical skill of Grade 2 Foundation Phase learners.

3.6.4. Sampling the respondents

For this study, the sample size involves the grandmothers and, Grade 2 Foundation Phase teachers in the East London Education District. The reason for selecting the grandmother was simple, because she was the caregiver of the Grade 2 grandchild and who has a responsibility to act as the parent and the first teacher of mathematics to the Grade 2 learner. The three Grade 2 Foundation Phase teachers are selected because they are the driving force behind the teaching of children's mathematics (Al-Mahdi, 2009). Thus, these grandmothers and teachers are likely to have information about children's every day activities that can be incorporated in the teaching and learning of children's mathematics education. The next session discussed the data analysis technique employed in this study.

3.7. Data analysis

Qualitative analysis is a non-numerical assessment of observation made through participant observation, document analysis, in-depth interviews, and other qualitative research techniques (Miles, Huberman, & Saldan, 2014). Most qualitative analysis is a relatively systematic process of coding, categorizing data to provide explanations of a single phenomenon of interest (MacMillan & Schumacher, 2010). Creswell (2010) put forward the following useful steps when conducting qualitative data

analysis: organise and prepare data for analysis; read through all the data; gain a general sense of the information and reflect on the overall meaning; conduct analysis based on the specific theoretical approach and method (e.g. narrative, content, grounded theory, discourse, archival, semiotics and phonemic analysis techniques). This process often involves coding or organising related segments of data into categories; generate a description of the setting or people and identify themes from coding; search for theme connections; present the data within a research report; interpret the larger meaning of the data.

According to Creswell (2013:199), the analysis of a good case study starts with the description of the case. The analysis also consists in “breaking phenomena into their basic parts and viewing them in relation to the whole form (Miles, Huberman, & Saldan, 2014). The analysis of this case study comprised the breaking down of data into categories and verifying whether or not they support the theory (Bryman, 2012). Since the researcher will be dealing with a single case study, the analysis also consisted of identifying the differences and or similarities of participants’ viewpoints concerning some of the questions, comparing some of the responses of the focused interview questions with those of the one-on-one interviews. Because qualitative research at most times is subjective, conformability will be brought to the interpretations by using quotes from the interviews (Niewenhuis, 2008).

Both content and thematic data analysis were employed in this study. According to Niewenhuis (2008) content analysis is a general term for a number of different strategies used to analyse texts. It is a systematic coding and categorising approach used for exploring large amounts of textual information unobtrusively to determine trends and patterns of words used their frequency, their relationships, and structures and discourses of communication (Leedy & Ormrod, 2013). According to Bloor & Wood (2006), the purpose of content analysis is to describe the characteristics of the document’s content by examining who says what, to whom, and what effect.

Thematic analysis was also utilised to analyse the interviews and shadowing. Thematic analysis, according to MacMillan & Schumacher (2010) is seen as an independent qualitative descriptive approach which mainly can be described as a method for identifying, analysing and reporting patterns (themes) within data.

According to Glesne, (2015) when using a qualitative analysis approach data are coded and categorised until themes are identified or emerge. Thematic analysis is a qualitative descriptive method that provided core skills to researchers for conducting many other forms of qualitative analysis. Consequently, qualitative researchers should become more familiar with thematic analysis as an independent and a reliable qualitative approach to analysis. The choice to use the two analysis was that thematic analysis provides a purely qualitative, detailed, and nuanced form of data (Braun and Clarke, 2006) while content analysis allows the researcher to analyse data qualitatively and at the same time quantify the data (Glesne, 2015). Moreover, content analysis uses a descriptive approach in both the coding of the data and its interpretation of quantitative counts of the codes (ibid).

Data had been analysed in a three-phase format. The first phase focused on identifying and analysing areas that are similar and where interviewees had different views. This was followed by an analysis of patterns of data which will emerge from different households and schools. In the final phase, data and collected information have been examined to explore the relationship between the school and household context, the perceived view of the participants and the influence of promoting mathematical skills.

Data reduction is the first phase that the researcher will used to analyse the data. Data will be analysed according to the Data Analysis Model of Miles & Huberman (1994). All interviews were recorded and transcribed, continually coded and then analysed. This was done chronologically and thematically, in order to come up with the issues relevant and pertaining to the research problem and question (Creswell, 2010). Data collected from across households and schools was analysed to establish similarities and differences. This has enabled the researcher to compare the responses of participants. A list of major ideas that surfaced was reported (Creswell, 2010). Data have been linked to themes that emerged during the field research. An analysis of the written notes enabled the researcher to organise statements according to narrative stories told by participants. The data analysis process will be conducted manually.

3.8. Trustworthiness

Trustworthiness is of the utmost importance in qualitative research. In contrast to quantitative research, qualitative researchers attempt to provide an in-depth understanding of a phenomenon. Therefore, they prefer to use the concept of trustworthiness to measure reliability and validity within qualitative studies (Niewenhuis, 2008). Even though some qualitative researchers will still use the terms “reliability and validity”, but the manner in which they determine this reliability and validity differs from how it is done in quantitative studies. For instance, they may use different terminology such as “trustworthiness” to indicate validity and reliability. This term “trustworthiness” can further be divided into credibility, transferability, dependability and confirmability (Lincon & Guba, 2006). The latter are the key criteria of trustworthiness.

3.8.1. Credibility

This refers to the accuracy with which the researcher interpreted the data that was provided by participants. In this study, credibility was increased by spending long periods of time with participants in trying to understand them better. It was also increased by using triangulation, whereby the researcher used more than one research method to collect data (Glesne, 2015). A single method can never adequately shed light on a phenomenon under investigation. Using multiple methods facilitated deeper understanding of the provision of psychosocial support by teachers to orphaned learners in schools (Neuman, 2008). Consequently, data triangulation was achieved through the use of face to face interviews and shadowing. Credibility enabled the researcher to establish confidence in the truth of her findings.

3.8.2. Transferability

This is the ability of the findings to be applied to a similar situation and delivering similar results (Cohen, Manion, & Morrison, 2007). This was achieved by carefully selecting the sample within the context of the study.

3.8.3. Dependability

This refers to the quality of the process of integration that takes place between the data collection method, data analysis and the theory generated from the data (Packer, 2011). Dependability encourages researchers to provide an audit trail (the documentation of data, methods, and decisions about the research, which can be laid open to external scrutiny) (Barbbie & Mounton, 2007). Dependability shows that the findings are consistent and can be repeated (Cohen, Manion, & Morrison, 2007). Therefore, for dependability the researcher conformed to laid down procedure of conducting the study i.e. she was constantly interacting with the supervisor.

3.8.4. Confirmability

This refers to how well the data collected support the findings and interpretation of the researcher. Confirmability indicates how well the findings flow from the data collected (Creswell, 2010). To achieve confirmability, the researcher offered a self-critically reflexive analysis of the methodology used in the research.

Another way in which validity of data collection can be increased in qualitative research is by doing member checking (Creswell, 2010). In this process the researcher took the information collected from the respondents back to them for them to verify and confirm if the researcher's interpretation adequately represented their reality (ibid). The following section deals with the ethical considerations

3.9. Ethical considerations

A basic guideline is that the researcher should make sure that no individual suffers any adverse consequences as a result of the study and will also be attentive to maximizing positive outcomes of the research process (Feza, 2015). I took cognizance of this guideline during the course of the study. Collecting data from people raises ethical concerns (Sotuku & Duku, 2015). Thus, in undertaking this study the following ethical considerations were observed:

3.10. Negotiation of entry

This is the most important practical stage in the process of planning for research project. A research project needs one to get permission or approval of stakeholders and meet criteria for accessibility. Seeking access is important because legislation (Data Protection Acts of 1984 and 1998) seeks to ensure that personal information will not be abused. Moreover, it is important that one get access from organizations, in effect, gatekeepers, and it is important to understand the reasons why they will not open the gate to anyone. There are reasons for gatekeepers to do so such as the information held is confidential, promises have been implied or given, and research takes up staff's time and often requires space like a desk for the researcher.

3.10.1. Confidentiality

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I completed research ethics forms from the University of Fort Hare's Faculty of Education Research Ethics Committee and the ethical clearance certificate was issued (see Appendix A). The Eastern Cape Department of Education was requested for permission to conduct research in schools in the province (see Appendix B). I also wrote to the principals of the three primary schools to seek permission to do the research in their schools (see Appendix C). Contact with prospective participants was sought through face to face interaction. Participants were also provided with a cover letter which clearly described the research and its purpose and its anticipated contribution to the field of quality in teaching and

information about protecting of rights, confidentiality and the voluntary nature of the study. After aspects of gaining entry were considered, equally more important principles of ethics were ensured.

3.10.2. Anonymity

Anonymity is a stronger guarantee of privacy and respect (Sotuku & Duku, 2015); hence it is essential that the participants remain anonymous throughout the study, even to the researchers themselves (Liamputtong, 2008). The names of the respondents will not appear on the research instruments or the data. Interview guides bear no names. I informed my participants not to give me their names, so in this case pseudo names were used to promote privacy and anonymity. This was done to ensure that the principle of anonymity is upheld. For schools, the names will be Sinovuyo, Lithemba and Head Start. The participants were made aware that this study will by no means reveal their identities, nor link responses with participants' identities, unless they give permission for that. Pseudonyms for participants were also used.

3.10.3. Protection and welfare of participants

The researcher has an obligation to protect the respondents from physical or mental harm. Liamputtong (2008) claimed that ethical obligation rests with the researcher to protect subjects within reasonable limits from any form of physical discomfort that may occur during the research work. The study should not present a risk that is higher than what the person would encounter during the course of their normal lifestyle. All interviews were conducted at places where the respondents felt safe. For instance, venues were identified by respondents as to where to conduct the interviews.

3.10.4. Informed consent

Participants should be informed of all aspects of research that might be reasonably expected to influence their willingness to participate in the research. They should also be informed about what it is that they are volunteering for as well as be given a brief description of the purpose of the research. Sotuku and Duku (2015) opined that

nobody should ever be coerced into participating in a research because participation must always be voluntary. I wrote letters of consent to all the participants and delivered them myself to all the respondents. Through these letters, respondents were informed of all aspects of the research such as the brief description of the purpose of the study. They were also informed that participation is voluntary and the information gathered from them would be a matter of concern between only me as a researcher and the supervisor. For instance, the use of the tape recorder was first discussed with the respondent concerned and they did not agree to be recorded.

3.10.5. Rights to withdraw from investigation

The researcher should under no circumstances force participants to participate or continue unwillingly with the study. Sotuku and Duku (2015) opined that nobody should ever be coerced into participating in a research because participation must always be voluntary. The researcher adhered to these principles in the study throughout by avoiding risks, gaining of participants, debriefing and informing participants of their right to withdraw from the study. Each and every time the researcher was to interview a participant she checked if the participant is still willing to do the interview.

3.10.6. Debriefing of participants

After data collection participants must be given all information they need. Liamputtong (2008) stated that the easiest way to debrief participants is to discuss their feelings about the work immediately after the session, telling them the result of the study. The researcher should also discuss with them their experiences of the research process so that unintended or unanticipated effects can be monitored. The researcher showed the respondent the field notes as a way of confirming that what was written on the note book of the researcher was exactly the same thing as what they said. I ensured that I rectified everything that might have arisen in the minds of participants immediately.

3.10.7. Release or publication of the findings

Huysamen (1993) felt that it is desirable to present the findings to subjects as a form of recognition and to maintain future good relationship with the community concerned. Data and findings of the study were reported without altering any information. Also, the findings of the study were honestly reported to the educational research community in conference proceedings and journal articles. I also ensured the respondents that the information is only to be used for the sole purpose of the investigation and would not be given out to anyone.

3.11. Summary

This chapter's focal point was this study's research methods and methodology. The research paradigm, approach, design used was outlined and the subjects focused on were also identified. In addition, data collection instruments were discussed, that is the shadowing and interviews. Issues of ethical considerations and data analysis plans were also discussed. The following chapter deals with presentation of data and analysis.

Chapter 4

Presentation analysis and discussion of data

4.1. Introduction

The main focus of this chapter is the presentation and discussion of data generated through interviews and shadowing. The aim of this research was to explore what home activities do grandmothers use to engage their Grade 2 grandchildren to promote mathematical skills. Data presented for the study were collected through a qualitative approach, and qualitative data techniques were employed. Respondents investigated included six grandmothers, and three Grade 2 teachers. In recognition of ethical principles of anonymity pseudonyms that do not reflect the actual identities of the participants were used. The data to be presented in this chapter aimed to answer the following research questions:

What home activities do grandmothers use that may promote mathematical skills of Grade 2 Foundation Phase learners?

For the main research question to be answered, three sub-research questions were identified:

- What are the grandmothers' perceptions of their role with regard to their grandchildren's mathematics learning?
- How do home activities link with Grade 2 mathematics skills?
- How do grandmothers and Grade 2 teachers interact to promote Grade 2 learners' mathematical skills?

The succeeding section deals with themes and subthemes that generated from the data analysis of data collected. It is structured as follows:

- Profiles of study participants
- Themes and sub-themes

4.2. Presenting the profile

This section will be divided into two sections:

- Table 4.2.1 Presenting the profiles of grandmothers.
- Table 4.2.2 Presenting the profiles of Grade 2 teachers

4.2.1. The profile of grandmothers

Table 4.2-1:Presenting the profiles of grandmothers

Pseudonyms	Age	Geographical Location	Occupation	Race	Marital Status	Highest Education Qualification	No of grandchildren staying with	Relationship with the grandmother	Biological parent's Whereabouts
Tozi	56	Rural	General worker	African	Widow	Grade 5	2	Maternal	Deceased
Vuvu	44	Township	General worker	African	Single	Grade 8	3	Paternal	Deceased
Khamo	62	Rural	Entrepreneur	African	Single	ACE	8	Maternal	Student
Thando	64	Urban	Entrepreneur	African	Divorced	B Com	3	Maternal	Migrant labour
Sapho	61	Urban	Pensioner	African	Single	Grade 8	5	Maternal	Divorced
Kholi	55	Township	Pensioner	African	Divorced	B Ed	1	Paternal	Migrant labour

Table 4.2.1 shows that six grandmothers participated in this study. All of the participants were Black Africans, with two residing in rural, township and urban areas. The majority of grandmothers fall within the age of 50-65, with the youngest being 44 years old. Table 4.2.1 also indicated that all six participants were heading households of which one was a widow, Tozi, three were single, Khamo, Sapho and Vuvu and with two divorced, Thando and Kholi.

The table also shows that, of these six grandmother participants, two are paternal grandmothers and four are maternal grandmothers. According to the table, it is shown that some of these grandchildren's biological parents died, whilst others were still students as they are still teenagers, however, it also transpired that some biological parents were working in other provinces at the time of the study and, therefore, living their children with their mothers. This is what motivated the researcher to explore what do these grandmothers do that can be used to promote mathematical skills of Grade 2 learners

With regard to the classes of participants three households fall under the middle class whilst the remaining three fall under the working class. Individual variability in young children's mathematical development has been associated with socio-economic status (Jordan, Kaplan, & Ramineni, 2009). Further revealed by Table 4.2.1 was that two of the six grandmothers, Tozi and Vuvu, were working as general workers whilst, two grandmothers, Khamo and Thando are both retired teacher and budget manager, respectively, were entrepreneurs, on the other side, two grandmothers, Kholi and Sapho, were pensioners at the time of the study. The results of this data concur with what Makalima (2010) argues, namely, that grandmother-headed are the 'poorest of the poor'. An interesting further revelation was that three of the six grandmothers, Khamo, Thando and Kholi, had college or university qualification.

4.2.2. The profiles of Grade 2 teachers

Table 4.2-2:Profiling Grade 2 teachers

Pseudonym	Age	Gender	Race	Highest educational level	Teaching experience in teaching Grade 2	School Name	Type of School	School Area
Thuliswa	58	Female	Black	ACE Special needs	More than 8 years	Sinovuyo	No fee paying	Rural
Bulelwa	37	Female	Black	BEd Intermediate Phase	More than 5 years	Lithemba	No fee paying	Township
Jessica	33	Female	White	BEd Honours Foundation Phase	More than 5 years	Head Start	Fee paying	Urban

Table 4.2.2 shows the three schools and three Grade 2 teacher respondents who participated in the study. The table also shows that all three participants are females. A possible reason for this phenomenon can be that the research sample involved only primary schools and primary schools tend to appoint more female than male educators (Makeleni, 2016).

Regarding to age, the majority of educators in the research sample are in the age group 30-40 years (Table 4.2.2), and this means they have more to offer in terms of energy and productivity but might have no much experience. From table 4.1.2, the teacher qualification is a good reflection of what qualified teachers should be made up of. It transpired that even though all participants have professional qualifications, two teachers from schools Sinovuyo and Lithemba were not of foundation phase teaching. This data confirms what Singh (2011) argues of South African teachers, that their qualifications are incongruent with what they teach, which results in incompetence amongst other teachers.

As indicated from table 4.2.2, the said experiences range from a minimum of five to eight years teaching Grade 2 class. This experience period seemed to have a negative influence on Grade 2 teachers, thus they view grandmothers as partners in their grandchildren's education. All educators in the research sample have less than ten years' experience of teaching a Grade 2 class. Experience together with the adequate training is needed for responsibilities and demands imposed on educators (Makgopa & Mokhele, 2013). The more experience and training an educator has, the more confidence and expertise s/he will have acquired to be an effective educator. Mokhele (2013) argued that continuous professional development and experience are prerequisites for educators to keep up with the rapid pace of change in knowledge, advancement of technology and increasing demands imposed upon educators.

In accordance to the focus of the research, the schools where interviews were conducted are primary schools (Table 4.2.2). One school was selected for conducting interviews in rural, township and urban area. In general, a rural area is a geographical area that is located outside town and cities, with a low population density (Statistics South Africa, 2011). In South Africa, the term township usually

refers to the often underdeveloped urban area that, from the late 19th century until the end of apartheid, were reserved for non-white residents such as Blacks, and/or Indians (Howie, 2006). Urban is a human settlement with a high population density and infrastructure of built environment (Makalima, 2010). The discussion now moves to findings that came up during interviews and shadowing.

4.3. Presenting data

This section presents data analysis and discussion of findings collected from individual interviews with six grandmothers and their six Grade 2 grandchildren as well as three Grade 2 educators purposively selected. The main research question ***"what home activities do grandmothers engage their Grade 2 grandchildren to promote their mathematical skills"*** was the foci around which this section forms the analysis in this study chapter.

With the help of theoretical underpinning from the literature review of the study, the following three main themes emerged from the study:

- Their perception of roles
- Home-based activities and the interplay with mathematics
- Grandmother-teacher partnership

The following section discusses in detail the three themes that emerged from the study.

4.3.1. Their perception of roles

The data from grandmothers was analysed to answer the first research question, "what are the grandmothers' perceptions of their roles regarding their grandchildren's mathematics education?" All six grandmother participants provided an insightful description of their roles regarding their grandchildren's' upbringing and mathematics education.

4.3.1.1. Grandmothers as caregivers

All grandmothers indicated that they view their role as primary caregivers to their grandchildren. However, three of grandmothers reported that they are not just grandmothers to their grandchildren but also the only parents they have. The latter refers to those grandchildren whose biological parents were reported to be deceased and divorced (see Table 4.1.1). These grandmothers' perceptions of their role seemed to be influenced by their own childhood experiences; here are some examples of what these grandmothers narrated:

Some of these grandmothers reported that they see themselves as primary caregivers. For example, Tozi a 56-year-old grandmother of two who worked as a general worker reported:

> *"I see myself as the provider of everything they need, I am the only parent they have both of their biological parents died in different tragic events"*

As a follow up question, the grandmother was asked how this role made her feel. Through silent tears, Tozi emotionally expressed:

> *"Yho! Yandonzakalisa kuqala into yukuswelekelwa ngumyeni nayintombi yam (the death of my husband and daughter pained me). I was worried when my daughter died giving birth to my second grandchild, because they are both boys and boys are troublesome, but thank God they are best things I ever had".*

Similarly, Vuvu a 44-year-old general worker from a township area lives with two, and one is a Grade 2 grandchild (Mvuyo) shared:

> *"Even though, I am his grandmother I view my role as a mother. I think it is my responsibility to give him motherly love and to provide him with everything he needs. I want to give him all that I wished for but could not get when I grew up".*

Correspondingly, Khamo a 61 years old retired grandmother of eight grandchildren, but an entrepreneur at the time of the study from a rural area shared:

> *"Growing up without my family made me realize the importance of being there for my grandchildren no matter what. I have been raising him since his birth because his mother (my daughter) is not able to care for him because she has to finish her studies. I do not know much about what he is taught but I make sure that he eats, goes to bed early and prepares for school in time."*

Thando, 62-year-old grandmother of three grandchildren mentioned:

> *"My role basically is to be the head of this family since I am a divorcee, so basically I provide Sona with everything he needs to grow well. I hand buy all the necessary resources and material for him to learn"*

Since she reported herself as a divorcee, a follow up question on how she feels of the role she is playing was asked and she shared:

> *"It was hard at the beginning to be a divorcee. Losing my marriage was like losing my whole life; I lost everything I worked for more than forty years to obtain. I was feeling lonely, the day Sona was born was like I was born again as well because he is my first grandchild and my daughter has just started working. I knew from that day I was given another chance to have a reason to live".*

Sapho a 61-year-old grandmother of five, but who stays with two of her daughter's children shared:

> *"I am currently raising for my daughter two children. I actually have had my grandson since he was born. I picked him up from hospital. My daughter got divorced because she had some alcohol problems and has a rough life. I am very hurt by my daughter, she was a very good child and clever but she started hanging out with a wrong crowd.*

As a result, Soso has a rare heart condition. I do not want her full involvement with kids not unless she recovers. Their mother's behaviour might put too much mental pressure on him. I just want him to grow up with pleasant memories and have hope for his mom. I see my role as to ultimately provide every aspect of his life, I have to make sure that he has food, clothes, and goes to school".

Kholi a 62- year old grandmother of eight grandchildren described her role as:

"As a grandmother my role is just to help in whatever way I can. I feel like embracing the concept that it takes a village to really raise a child. I took my Grade 2 grandchild to be with me because her mother lost a baby boy in a house fire, which my granddaughter Zano had to witness. My granddaughter has had a lot of loss in life and I did not want to take the mom completely out of her life. I never going to be able to replace her mom, but I do my best to provide for a decent life for her while her mother works to get her life together. I wanted my granddaughter to know that she has family and we love her, and we will make sure she stays with family".

A caregiver is defined as one who stands in the place of a child's parent, but who is not that parent (Mudavanhu, 2008). These findings seemed to correlate with the definition supported by (Schrijenis & Smit, 2014) who refers to a caregiver as an individual who acts in place of the legal parent to make decisions about the child when no parent can be located or identified. Further, these findings concur with Plaatjies (2013) who argued that in many cases, these mere ethical qualities result from the fact that most grandmothers reject the authority and nurturing function of parenting.

4.3.1.2. Role as protectors

Protection slightly differed from providing in that is a role to which majority of grandmothers reported to be undertaking. All grandmothers reported to view their role as protectors of their grandchildren in order for them to be successful in life.

Some of grandmothers reported to protect their grandchildren from emotional harm. For example, Sapho shared:

> *"I remember a time when my grandson was asked to tell the teacher what he wants to be when he grows up. Musa came home extremely hurt because of what the teacher said to him. He told the class that he wants to become like Nelson Mandela. He told me that his teacher afterwards pulled him aside and said it is good that he wants to be like Mandela but, she thinks he was dreaming too high, he should have set his goal at least at becoming maybe a truck driver. I went to school to support him and to protect him from being humiliated ever again. The teacher dismissed my claims but I told her that I would go further up the chain until someone heard my displeasure with this comment. I think you have to be visible in the school so that teachers know that this child has someone who cares."*

One grandmother reported to provide her grandson with motherly love so that he does not feel the void of not having his mother around. Vuvu shared:

> *"I make sure we talk every day of what may have hurt him, one day he came from school telling me that, they were asked to draw their family tree, starting from the grandparents until children. He can home very hurt that he did not know whether to make me a mother or a grandmother, until he put me as both a mother and a grandmother. I could see that he has many questions, I talked to comfort him until I was sure that he was okay emotionally"*

Some other respondents revealed that they protect their grandchildren from the violence that happened in their neighbourhood, and that they have to make certain they are always safe and grow up knowing what is wrong and right. For example, Thando mentioned:

> *"I make sure that he is well cared for, and always protected from the violence within the neighbourhood. I always make sure he is surrounded by people who will do him no harm, and I take him to*

church with me to build his character. There is a lot out there, drugs and alcohol; I do not want him to be exposed to such so early in his life"

A majority of grandmothers reported that they take their grandchildren to church in order to build their character and for them to learn what is right and wrong. They believe taking young children to church reduces chances of socializing with wrong crowds. Some believe fearing God leads to respecting other people. These grandmothers strongly believe that if the children fear God they will then be able to do things right. For instance, Kholi said:

"We go to church together every Sunday, he first attends Sunday school, then main service and I teach them to know God as their father and protector"

Likewise, Vuvu, noted:

"I do not want him to feel sorry for himself, so I take him to church so that he knows that Jesus is the father to those who do not have fathers"

Two other respondents conveyed a different view of protecting their grandchild, Khamo and Sapho noted, they have to protect their grandchildren from intellectual harm. These grandmothers reported to do so by monitoring what their grandchildren watch on TV and the time they spent watching the TV. These grandmothers are of the view that some TV programs my hinder cognitive development of the child. This also applies to the time children spent watching TV. This is what one grandmother said:

"I monitor what she plays and watches on TV because some of these programs on TV or games they play do not stimulate their mind. I believe in interacting with her to stimulate her mind than her watching TV."

Equally so, Tozi affirmed that she does not want her grandson to play outside too often.

"There is a lot going on out there. I have learnt from his mother's deeds; I do not want loose him too. I am very sensitive of what can corrupt his mind. I prefer him to stay indoors. I am here to talk to him; in fact, there is no time to go play outside. It is like a waste of time, the time we are supposed to talk about what he did at school and do home works together"

These grandmothers seem to understand that bad parenting behaviours lead to inhibited cognitive development and increased behaviour problem in children of all ages. Conversely, these grandmothers understand child outcomes are interconnected within and across diverse domains of development. They result from and are enhanced by early positive and supportive interactions with parents and other caregivers. The importance of this kind of role these grandmothers provide is also confirmed by Masten & Cicchetti (2010) that, effectiveness in one domain of competence in one period of life becomes the scaffold on which later competence in newly emerging domains develops. From the data, it emerged that these grandmothers do not only view their role as protectors but also as a source of social support to their grandchildren. The importance of this kind of involvement that grandmothers provide is as confirmed by (Melhuish, et al., 2008) who discovers that every person-to-person interactions literally shapes the human brain and that the more important the relationship the more profound the effect of these interactions on brain development.

4.3.1.3. Role as home-based teachers

As the follow up question grandmothers were asked of their role regarding their grandchildren's mathematics education. All grandmother participants agreed that as parents to their grandchildren they are the primary educators and therefore the most important and influential persons in the children's lives (Al-Mahdi, 2009). Different opinions were reported by grandmothers and these reports revealed that grandmothers play significant roles in the enhancement of their grandchildren's interest for mathematics. Some of these grandmothers perceive their role of teaching their grandchildren through providing them with variety of resources and materials

that provide children with opportunities to practice mathematics at home. For example, Khamo revealed:

> *"All my children did mathematics up to Grade twelve; it is a family norm to do mathematics. I always tell my grandchildren that mathematics is like solving problems in real life so they should keep that in mind when doing mathematics. I make sure that there are more than three mathematics textbooks for Mahle to practice what she learnt at school. Every afternoon she has to do mathematics on the same topics she learnt at school from three textbooks. When she seems not to understand I explain what is required by making examples from what we do at home, I then mark her. In that way, I will know whether she understands or not then I teach her if she seems not understand"*

Likewise, Thando reported,

> *"I have bought him a computer with a variety of mathematical soft wares so that he practices what he learnt from school. Also as we engage in business activities, I pose problem solving question that are mathematically related just to show him that mathematics is in everything we do. I believe that improves his mathematical thinking"*

Kholi affirmed that she inspires her grandchild by:

> *"I always ask her mathematics related questions as we engage in household chores. I sometimes ask her to count and recognize numbers from print as much as possible. I don't think children do enough counting and recognizing of numbers. Most children count when they absolutely have to count, they do not know the meaning of numbers"*

Some grandmothers on the other side mentioned that they do not know their grandchildren's mathematics, so all they do it motivate them to do well.

For example:

Vuvu offered:

> *"I know he has the ability; therefore, I keep praising him to do the best he can"*

Sapho affirmed:

> *"I do not know how to assist him in mathematics, I have been out of school for a long time but I ask him to teach me what he was taught at school and then I assist him to do his work accordingly"*

Tozi mentioned:

> *"I ask her to read the instruction before we do anything, to me reading is a better way to integrate mathematics into her everyday life".*

From the data it appeared that some grandmothers deliberately encourage their grandchildren's interest in their mathematics learning through various means. It also emerged that these grandmothers consider their grandchildren's education as vital. Based on the above perceptions that influence grandparents' views of their role, it became evident that grandparents become involved in their children's mathematics education because they have developed a parental role. The following section discusses home-based activities grandmothers reported to engage their Grade 2 grandchildren in.

4.3.2. Home-based activities and grade 2 mathematical skills

This section presents data which revealed that mathematics was put into use through different categories of home- based activities that grandmothers engage with their Grade 2 grandchildren. The following categories of home-based activities were identified:

- Everyday Chores
- Special chores
- Fun, games and playful

Following the research question two, it became important to consider how these home activities relate to Grade 2 in mathematics as specified by the CAPS (DBE, 2012). Data from this section demonstrated that the knowledge gained by Grade 2 learners at home reinforces, compliments, and extends the mathematics learning taking place at school.

4.3.2.1. Everyday chores

All the study participants shared that they engage their grandchildren in various household chores activities. The data revealed that, the bigger category of home-based activities form part of what families do in their everyday lives. These include physical related chores, financial related and context relevant activities.

4.3.2.1.1. Physical training chores

All grandmother participants confirmed that they do engage their Grade 2 grandchildren when cooking and baking, cleaning, laundry, gardening and landscaping. Data revealed these home activities as those that develop children's physical training. Various grandmothers share very interesting moments as they engage their grandchildren in cooking and baking.

Many of the grandmothers confirmed to engage their Grade 2 grandchildren when cooking. For example, Khamo cited:

> *"I remember the first time we cooked together. We were cooking pasta (spaghetti), rice, and mincemeat, which is her favourite. I first described the ingredients we need and the whole cooking process. Yho! She poured a lot of water and the spaghetti got overcooked such that it was like porridge. I then realized that I had to teach her step by step, this was important that she knows how to cook her spaghetti as*

she wants to have every day, and that she has to first consider the number of people she is cooking for. Today she cooks for eight people and gets her measures of ingredients correct. I only I told her that one cup of rice serves two people. I also told her that to cook one cup of rice she needs two cups of water. When she has to cook for more people, she understands that she has to increase or decrease from the ingredients depending on the number of people she has to cook for".

Equally, Thando the catering and events company owner, reported that she engages her Grade 2 grandson when planning events but she shared that Sona enjoys baking cupcakes, she reported:

"He is always on his computer searching for new recipes, once he finds something interesting he writes the recipe and the ingredients in his scrapbook. One day he saw a beautiful picture of a beef stew whilst we were watching TV and asked if he could try to cook the stew. Since he did not have a recipe, he became confused on ow much salt to put. I then taught him to put the salt in the palm of his hand to estimate it. He did not understand at first but I told him that's how it has been done and he tried it and it worked'

As grandmothers read the instruction with them, the correct use of the language of fractions and measurement is increased and number vocabulary is also developed as the grandmothers' talk during the cooking activity. Fractions measurement technically is finding the length, height, and weight of an object using units, feet or hands. Grade 2 grandchildren were using cups, teaspoons and table spoons to measure ingredients.

During the cooking activity, counting skills are also enhanced as grandmothers' cook and bake with their Grade 2 grandchildren, for example, counting the amounts of each ingredient being used in recipes; counting the numbers of items being made such as cupcakes etc. Reading the number off the recipe and then count the cups or spoons required; count the cutlery when you are setting the table.

Cooking and baking also provides Grade 2 children with plenty of opportunities to do some “estimation”. Estimation is the ability to make a good guess about the amount or size of something. For example, “increasing and decreasing”: as Thando asked Sona to put salt at the palm of his hand to see if it will enough for his beef stew he was cooking. From this data it was revealed that Grade 2 children were encouraged to “measure” objects using non-standard units such as spoons, and cups to estimate.

Moreover, setting the table activity emerged in most households, this help Grade 2 learner reinforce one-to-one correspondence; each person gets one plate, one fork, one napkin, one cup, etc.

4.3.2.1.2. Cleaning and Packing items

All grandmothers confirmed that they engage their Grade 2 grandchildren when cleaning and doing laundry during weekends. For instance, Tozi noted:

> *“Since I am working during the week, we do spring cleaning every Saturdays, we have to sweep and mop all bedrooms”. However, Tozi also shared that she forces him to do household chores because he does not enjoy doing household chores but she mentioned that he at least does the packing of groceries and laundry, starting from sorting clothing items to putting them to dry outside.*

Vuvu affirmed the same:

> *“We do laundry together on weekends, Mvuyo does all the sorting of clothing items in accordance to their colour of brightness and darkness. Since we do not have running water Mvuyo and his uncle use a wheelbarrow to carry fifty litres of water”.*

Sapho claimed that she does cleaning with her grandchildren on weekends.

Through packing groceries Grade 2 grandchildren had to carry a 1kg bag of sugar to feel how heavy it is. Packing activity can develop their estimation skill, as they carry other packages they will compare the weight to that of 1kg sugar. Packing also

exposes Grade 2 learners in counting skills, comparing skills such as same as, bigger, smaller etc. Packing further promotes children's number operations (addition and subtraction), and relationships such as one more, etc. In addition, it helps children to explore patterns and shapes such as flat, round, circle, square, triangle, rectangle, and star.

More to the above, cleaning and packing groceries extend position and orientation skills such as on top of, top, bottom, side, forwards, backwards, over, under, in front, behind, next to, between, roll, turn, stretch. Finally, it helps children follow instructions, such as carry on, start from, put, and place, what comes next? A strong sense of numbers, and how they are used, will enable children to understand place value, e.g., that the number "256" consists of two groups of one hundred (200), five groups of ten (50) and six ones (6), as required in grade 2. Understanding place value is necessary in learning mathematics as it precedes solving complex addition, subtraction, multiplication, and division problems.

4.3.2.1.3. Laundry

This section presents grandmother responses as they engage in laundry with their Grade 2 grandchildren. All participant grandmothers also expressed how they engage their grandchildren in doing laundry. Most of the grandmothers (Tozi, Vuvu, Sapho and Kholi) in similar vein noted:

> *"On Saturday we do laundry, my grandchildren do the sorting of clothing items. We wash all the bright clothes alone and later wash the dark ones"*

Thando mentioned:

> *"We use a washing a machine." She mentioned that Sona knows how to operate it to wash and dry.*

Khamo noted:

“I do not do laundry; I have arthritis but Mahle does laundry with other family members. Her job is to pile up all the socks and when they dry up, she has to match same pairs together to pack them nicely”.

By grouping, children identify a common feature to form a group, to separate from other groups. Classification is important to learning to organize knowledge ideas. Children need to learn to discriminate differences, to reason and analyses, and select items to form groups. In matching, the child can learn to identify which items are the same and which are different. The ability to discriminate differences is important to all sorts of learning areas not just mathematical concepts, for example, learning to recognize the difference between similar letters (b + d) is important for learners to read and write.

By comparing, the child is learning to look more at colour, size, shape, pattern and number of items in order to compare items or groups of items. Thus children learn to look closely at similarities and differences between two different items or groups.

4.3.2.1.4. Sewing and beading

This section presents data findings in which grandmothers reported to engage their grandchildren in sewing. Khamo’s household describe using mathematics in sewing, which is a hobby at home, and discussed how dimensional analysis was like a “door opening” to help her understand patterns to make prediction of what comes next. Khamo shared:

“I have decided to engage Mahle when I sew because one day I found her cutting the material, with the intention to surprise me. She did not measure the window first, so I had to start from scratch teaching her the steps one takes before she does sewing. We then started by sewing her doll’s dress. I taught her how to design and to make a pattern from the design to cutting the pattern then sewing the garment”

Likewise, Thando shared that her old grandson, has a Diploma in Fashion Designing. Sona shows a lot of interest in designing of the garments, he helps in drawing and in developing a pattern.

4.3.2.1.5. Financial related chores

This section presents findings that emerged, through which grandmothers engage in home activities that emanated from financial related chores. Data revealed stories relating to household identity of activities they engage in describes mathematics in the context of helping to personal responsibility, particularly as related to budgeting and finance.

For example, in the household of Tozi, a general worker, she described how she and her family used mathematics to determine whether they were making a financially sound spending decision, considering how much the family had to spend, as well as whether the item was of good value. Tozi shared that her two grandsons, ages, 7 and 10, keep a record of the money they had in their banks and any money that they spent, she further shared:

> *"They know that every time they get money from the social grant. They record it down; we have a little money book. We then list what need to be bought and we only buy where there is a special. We watch TV then we compare prices from different grocery stores to make sure we buy from specials."*

For the grandmothers these decisions were an attempt to balance the family's needs with the desire to be personally responsible for the family finances. Related to this example, Thando mentioned

> *"I give all my grandchildren pocket money every month to decide how they will spend by making their own budget".*

Similarly, in Kholi's household on the day of shadowing, I overheard Khanya (Grade 2 grandchild) talking to her grandmother saying:

"The dress I want to buy for my birthday is on sale. I have calculated the discount. It will fit in my budget"

Vuvu shared that in December she gives her grandchildren money to go buy clothes for Christmas. She shared what Mvuyo does:

"When they want to buy something, they always have to think about how much they still have to spend. If it is their money, they get really stingy and conservative"

Interesting findings were revealed from this data, because what they do in theory is value-cost analysis in their head. They will say I want to buy this. How much does it cost? Once they know how much does it cost, you will hear them saying, I do not want it, or it's not exactly what I like. Majority of the grandmothers except Vuvu (Gr2) described having her grandson Mvuyo total her monthly bills once she had paid them all.

Tozi mentioned;

"My grandchildren know that I have to pay my funeral insurance policy and stokvel (community savings) they are everything to me, we do our budget together and they assist me to decide on what is needed most".

Tozi and Kholi confirm to do shopping with their grandchildren, with the hope to teach them about the value of money.

Kholi reported:

"Yes, I do shopping with my granddaughter. She makes and keeps the list of groceries needed at home. During shopping she is the one who weighs all items such as vegetables and meat. In fact, she is the one who pays, I want her to know the value of money".

Through shopping and weighing of grocery products- Grade 2 grandchildren learn to weigh fruits, meat and vegetables at the grocery store and estimate the cost

(Ginsburg, Lee, & Boyd, 2008). Let them pay the clerk in the store and then count money to ensure it's the correct change, children learn about volume.

4.3.2.1.6. Context relevant chores

This section reports on home activities that are part of household practice in daily lives but that happen in certain contexts. Data from this study shows that some of the activities grandmothers engage their grandchildren only took place in different context, most commonly in rural areas. These include carrying water (*ukukha amanzi*), herding animals (*ukwalusa*). This activity commonly appeared to all rural and in one township household (Vuvu' s).

Tozi articulated,

> *"After school both of them have to go fetch water from the nearby community tap." However, she mentioned that Nhanha (Musa - Grade 2 learner) carries a five litre container but he has to fill up a twenty litre bucket. This means Musa goes to the tap four times to fill up the bucket.*

Similar, Vuvu cited,

> *"When doing laundry Mvuyo carries water from the tap, but he uses a wheel barrow to carry fifty litres of water, he does this by going to the tap ten times with his five litre container." Seemingly, Khamo shared the same sentiments when she reported: "We carry water from the well, after school we fetch water from the well to water the vegetable garden, cook, to do laundry and for drinking".*

However, very interestingly, carrying of water also appeared from, Vuvu even though her household is in the township area. Having to carry water, children use measurable containers that lead to exploring the relationships between volume of water, and its weight. Also, having to balance the container on the head without hand support, and sometimes these women (grandmothers) put leaves on the open top of

the bucket to minimize splashing of water. This procedure teaches Grade 2 learners balancing and problem-solving.

4.3.2.1.7. Herding Animals

Both Tozi and Khamo from rural areas reported to engage their grade two grandchildren in looking after the animals they have. For instance, Tozi reported:

> *"After school Nhanha first has to check if all chickens and pigs are there, he has to feed and provide them with water to drink before he goes to play."*

Similarly, Khamo also reported:

> *"She has to go check sheep and goats and count them to see that they are nearer home".*

These findings are in line with Chinese families' use of animals as a theme to draw these young children into the field of mathematics Ramani, Hirsch-Pasek, & Pan, (2014). Mathematics activities using animals cannot only build mathematical skills, but could also increase vocabulary, build fine motor skills and improve reasoning. Young children can organize animals according to size.

Herding cattle can be used to teach children counting and the concept of time, which is fostered when children have to know the exact times to take the livestock out of and back into the kraal.

4.3.2.1.8. Gardening and Landscaping

This section seeks to present and analyses data that emerged as grandmothers engage in gardening and landscaping with their grandchildren. Three out of the six grandmothers said that they do engage their grandchildren when doing gardening and some landscaping.

For example, Thando reported,

She asked her grandson to scale down the dimensions of the area where they can plant vegetables including landscaping features that could not be altered.

In the same way, both Khamo and & Tozi attest to do gardening with their Grade 2 grandchildren, they both share they have to think about spacing of each plant before we plant. Important to note is that, different vegetables require different spacing. They both mentioned that before watering the plants they ask their grandchildren to first guess the amount of water that will be needed. For example, Tozi asks Nhanha:

> *"How much water do you think we need to water all the vegetables?"*

Likewise, Khamo commented:

> *"Yes, I do gardening with my grandchildren; in fact, that's what I enjoy doing most. Mahle assists in preparing the soil and measuring plots. She understands what to plant in which season and understand the spacing needed for plant, for example I have taught her what a ginger tree needs. On our first day I asked her to prepare the land to plant about twelve of them."*

Through gardening, Grade 2 grandchildren are exposed to guessing, and guessing encourages estimation skills. Estimation is the ability to make a good guess about the amount or size of something. Gardening and landscaping Grade 2 also expose children to measuring skills such as, length, area, and width of the seed bed.

Moreover, gardening also enforces measurement of time (in minutes, months of the year also falls under the skill area of measurement). For example, gardening is dependent on the seasons of the year; every plant has to plant in its own season. For example, maize needs to be planted between the end of spring and the beginning of summer and it gets harvested during the end of autumn and the beginning of winter each year. Seasons of the year are clustered around from the twelve months of the year. Even though these Grade 2 grandchildren in these grandmother-headed households did not know that they are practicing not only basic computation, but also real-life mathematical thinking, exactly the kind of mathematics that challenges many South African students.

4.3.2.1.9. Sewing

Like many other families, they were quick to name calculation mathematical activity they engage in as something else rather than mathematics. For instance, I followed Kholi explaining a geometry rule about the equivalency of circles as she sewed costumes with Zano, but she contended that this was not really mathematics, it is "just sewing". This study revealed this because it was rich in mathematical thinking, yet the family engage it as a matter of practical work without attention to mathematics.

Through sewing and beading, mathematics has been commonly practiced by some grandmothers. Grade 2 learners get involved in using different coloured- and sized-beads to make nice patterns and shapes. Learners would be able to quantify the beads by counting, as well identify them by size, colour and shape.

4.3.2.2. Special activities

This section of data presents findings that revealed that grandmothers engage in special chores. These activities included recycling, and home improvement among others. Data revealed that these special chores contained magnitudes of Grade 2 mathematical skills

4.3.2.2.1. Recycling

On the day of shadowing Khamo's household, the researcher followed Khamo and her Grade 2 grandchild Mahle as they were sorting items they recycle. They reported that they do this activity once in three months. On my arrival, I found Mahle calling her friends who always assist in sorting the recycling items. I shadowed Khamo, Mahle and the seven other grandchildren. As I was shadowing them, Khamo instructed them to group themselves in three groups. In this way Khamo gave children the right to contribute and work out of their willingness. She then asked each group to decide on the items they wish to group together. The eight children grouped themselves into groups of 3s and 2s. I realized that one group of three was collecting glass and wood whilst another group of three was sorting steel, nails and wire items and the group of two decided to sort papers and plastic items. As the

teams were sorting the litter Khamo brought different kinds of containers that included paper bags, buckets, and bins. She then asked the teams to choose a container that fits the items they were sorting. Selecting an appropriate container that can fit a certain kind of litter require children to estimate the amount of litter compared to the available containers. Through recycling children learn to estimate, and compare. Mathematical skills that emerged from this activity are sorting, matching, classification and estimation.

When children finished the sorting, Khamo brought a slab of chocolate and four apples for them to share. She just asked them to share without telling them how. I followed Mahle and her friends as they were discussing on how to divide the chocolate. They counted the chocolate bars and realized that there were 24 and they then divide them accordingly.

From these activity children learn sharing skills which are necessary for division. Dividing the 24 bars of chocolate amongst the eight children forms the basis of doing fractions. Lines of symmetry are also fundamental mathematical skills needed for Grade 2. Through cutting apples into halve expose Grade 2 grandchildren into symmetrical knowledge which builds into fractions.

4.3.2.2.2. Home Improvement

Grandmothers' stories revealed different kinds of mathematics that are embedded in their home. For example, Kholi described, how she and her Grade 2 grandchild planned to revamp their kitchen cabinet remodel which involved balancing multiple constraints, including commercial (a desired corner cabinet only come in one size) and usage considerations (the best placement of the dishwasher for efficient work flow in the kitchen) that in turn led to two-dimensional geometric constraints (the most attractive option for the gap, a side rack, was also most expensive, which had to be balanced against other expenses and the desire to avoid wasted space), all among the conversions from metric to standard units, within the broader context of trying to create an attractive kitchen space.

In this way, Kholi brought figuring and thinking together to solve problems. Kholi's description revealed a great deal of mathematical thinking, processing and communicating.

An interesting finding was that some of these stories mistakes were not necessarily without cost, but many grandmothers would let it go to allow the second and third tries. This has emerged when Khamo and Mahle were making mistake when cutting the curtain material without measuring the window first.

This was also evident from Sapho who shared:

> *"Recognizing that we might make measure incorrectly while wallpapering, we purchased some extra materials in case of mistakes."*

4.3.2.2.3. Painting

Mathematics and painting are interrelated in many ways. One can obviously use mathematical geometry to analyses painting, figurative, or abstract, in terms of shapes such as points and lines, circles and triangles. Mathematics can be seen as painting without using the brush, and painting as mathematics without the chalk. These were observed as shadowing some households, for example in Khamo and Thando households, an observation of wall painting and different portraits.

Mathematics is the science of pattern and painting is articulation through patterns. Some of the art portraits present three-dimensional forms on two-dimensional picture surfaces, even curved ones, cylinders, triangles, squares, and rectangles as required in grade 2 mathematics.

4.3.2.2.4. Planning Family events

This data emerged whilst shadowing Vuvu' s household, they were planning for a ninth year birthday celebration for Mvuyo. Vuvu shared that the budget was tight, but we managed to save for Mvuyo birthday party. This is what transpired from the conversation.

“We are working with a tight budget, but I want you to have this birth day party. I have around five thousand rand to spend for the party,” said Vuvu. Mvuyo started to populate the budget. He had a pencil, paper, and a calculator at the table. He input amounts and recorded a list of what will be needed on the paper. Vuvu started the conversation by asking, “So what do we need to buy?” Mvuyo answered, “Shoes, party packs, meat and bread and snacks (sweets and chips).” Then he added a jumping castle on the list and Vuvu suggested that a jumping castle was probably too expensive, but did not completely rule it out. The two began establishing their priorities: Vuvu wanted Mvuyo to dress appropriately for his birthday and to do it in the budget, while Mvuyo wanted a jumping castle. By the end of the conversation they determined that they had two thousand five hundred available for the birthday attire and the jumping castle was contingent on leftover money. The budget was the family matter, and in the conversation Vuvu informed her sister that she was going to sacrifice some of her usual spending money for Mvuyo birthday. They then headed to the shopping complex for attire shopping.

Although the budget appeared, at first, to be a straightforward case of addition, and subtraction, it became more complex inside the social interaction of the family. In the space of a five-minute conversation, Vuvu and Mvuyo engaged in a budget negotiation to optimize everyone’s needs. They took into account the fixed and negotiation areas of the budget, prioritizing expenses, and laid the groundwork for future negotiation.

4.3.2.3. Fun, games, and playfulness

Finally, the data revealed that mathematics could be part of family fun. In Kholi’s household, Zano the Grade 2 grandchild described how she and her grandmother used to play games together. Zano mentioned:

> *“My grandmother likes to make fun mathematical story problems, which I have to solve. I like them because they are making me clever in mathematics in class”.*

Several families also mentioned using time in the car to do mathematics together. For example, Thando shared

> *“When we take long trips I ask Sona to calculate how long we will take to get where we are going, for example, I have a house in Bizana near Durban, before we leave Sone has to calculate the hours we will spent on the road”.*

Other activities of family fun that emerged included local, and board games. Some of the grandmothers shared that they do not have enough money to buy their grandchildren board or TV games, so they too allow them to play local the games. Playing local games to enhance mathematics reinforces the view of (Chikodzi & Nyota, 2010) that local games could influence children’s mathematics education. Tozi and Vuvu shared:

> *“I let my grandchild to go play indigenous local games such as umlabalaba, upuca, uchwele, ugqaphu, Imizi, iimoto zamacingo, udongwe, with their peers”.*

Ugqaphu or rope skipping is often played by children. Through this game, learners are taught counting skills, balancing and speed since they must adjust to the speed of the revolving rope. As they skip, they will be counting, and sometimes compete to see who would skip the highest count.

In a game of upuca, children throw a flat stone which they push with one hand from one box to another while balancing on one leg. Sometimes instead of rectangular boxes they use circles, which help learners develop the sense of shapes. The counting system is developed every time a player plays since they have to remember where they ended and where to start the next time. The concepts of mass, weight and balancing are also perfected in the process.

The game of *Umlabalaba* is played by two people, each with twelve identical objects, different from the opponent's. Players strive to block the opponent from forming a row, diagonal or column of three stones. If such a row is formed, an opponent's strategically placed piece is taken off the game. This goes on until one player's objects are finished. Sets, counting, symmetry, geometrical shapes, ratio, proportion and logical reasoning are some of the skills duly developed through the playing of this game.

Imizi or mud house play in English, is where children use mud to bake cakes using different shapes and sizes of containers available. The cakes are dried in the sun and figuratively eaten thereafter. Sometimes roles of family members like father, mother, daughter and son are modelled to make the activity livelier. A multitude of mathematical skills are developed, for example, volume, measuring length and identification of solid shapes during their modelling.

Udongwe or clay toys is an activity which see children designing different solids, animals and other things from wet clay. The objects are dried in the sun to make them firm and permanently hard. Children learn the skill of volume, shapes, measurement and patterns

Iimoto zamacingo or wire cars are made by young boys as toys, and which requires great skill. This teaches learners about measurement, length, symmetry and shapes.

Apart from local games, some grandmothers mentioned to play commercial games with their grandchildren:

Sapho mentioned:

> *"I like to play board games, monopoly, and chess snake and ladders with her grandchildren, but Soso enjoys making complicated projects out of blocks"*

During the interview Mvuyo got into the discussion to ask whether his hobby involved mathematics. On the day of shadowing Mvuyo was frequently checking the scores of his favourite sport.

4.3.2.4. Summary

In sum, data from this study revealed that mathematics at grandmother-headed household was used to help grandchildren with some problems that were routine and some that were unusual, some were simple and some were complex. Most of the grandmother stories portrayed successful problem – solving skills. This view was supported by Yaro (2015) who asserts that every family, regardless of their

economic circumstances, social class or cultural background, can provide valuable learning opportunities for their children.

These findings further revealed that mathematical skills were integrated in social activity among grandmothers, family members, and across a variety of contexts. One of the grandmothers Khamo shared: “I view mathematics as a peaceful practice; it did not always result in absolutely correct answers”. This seemed true as evaluation was against people’s personality but it was the task itself that was evaluated. Grandmothers represented mathematics as integrated into their activities; because they were not always sure what they were doing was mathematics.

Moreover, these findings were congruent to the aims as posit by the Pragmatic theory, that education must fulfil as well the needs of the society and children should be trained so that they are able to solve their present-day problems efficiency and to adjust themselves to their social environment (Dewey, 1931).

4.3.3. Grandmother-teacher partnerships

The promotion of mathematics is a complex task that involves many role players with overlapping responsibility. Feiler (2010) argues that parental involvement can take the form of cooperation which leads to participation and partnership. Partners are participants in the general activities, which includes tasks and responsibilities, shouldered on behalf of the common good, but they nevertheless remain separate "parts" with their own interests and goals (Al-Mahdi, 2009). In an institution like a school, a partnership refers to an institutionalized confidential relationship between partners, parents and educators (ibid). According to Okeke (2014) a partnership implies an agreement of co-operation according to which each partner will accept specific responsibilities and carry out commitments. However, the study revealed that there was no common understanding among the parties namely grandmothers, educators and learners that they all have a role to play in the promotion of mathematics, instead, teachers reported that they do not know how to involve grandmothers in their grandchildren’s mathematics.

4.3.3.1. Teachers do not know how to involve grandmothers

From the interviews it became evident that Grade 2 teachers do not know how to involve grandmothers in their grandchildren's mathematics education. This inability is furthered by the fact that grandmothers claimed that teachers do not seem to care of their input in their children's mathematics education. While teachers highlighted that grandmothers may not understand mathematics, there was, however, no evidence that the schools made any effort to stimulate the grandmothers' ability to promote the children's' mathematics. In contrast grandmothers believed that they fulfilled their roles.

Thuliswa, a 58- year old Grade 2 teacher with more than eight-year' experience, and holds an Advance Certificate in Education with Special Needs as the specialization reported:

> *"Mathematics, unlike other subjects cannot be understood by just anyone, one needs to have gone for a professional training to be competent. Some grandmothers are old, sick and some are less interested in their grandchildren's education. Most people not just grandmothers never like mathematics, that's what we get from their children".*

Bulelwa reaffirmed, a 37-year old Grade 2 teacher, from Lithemba primary school in a township mentioned:

> *"Grandmothers complain of small things; I do not think they can handle mathematics not unless they have to come to class so as to see us teach a mathematics lesson for them to be involved in their grandchildren's mathematics learning".*

Jessica, a 33-year old Grade 2 teacher, with more than five years' experience, shared:

"Our school has Grade 2 booklets, we call a parents' meeting at the beginning of each term to explain to them of what is expected, they do not come. So how are we going to get them for mathematics?"

These findings concur with (Christianakis, 2011) who contended that school personnel interpreted the lack of parental involvement as a sign they did not care about their children's education, instead of understanding the home and family structures children. These teachers' views seemed to correlate with Moeller and Blelfelt (2011) who argues that public school educator views may be influenced by their personal beliefs on the traditional stance that tends to consider families from disadvantaged backgrounds (e.g. working class, and low-income) as deficient (Moeller & Blelfelt, 2011).

The findings also concur with that of (Moeller & Blelfelt, 2011) who found that teachers perceive children raised by grandmothers as likely to occupy substantial amounts of school personnel time, further suggesting if teachers must spend much of their day focusing on the needs of these grandchildren, they will have less time to see to the academic and behavioural needs of other students. School personnel need a clear sense of their own ethnic and cultural identities in order to understand those of their students and families (Moeller & Blelfelt, 2011). The danger of obtaining knowledge about specific cultures or family structures is it increases the chance that school personnel will unintentionally act in inappropriate ways (ibid).

4.3.3.2. Curriculum prescripts not support nor acknowledging learner social capital

An interesting finding was revealed by the data, where Grade 2 Teachers reported that they teach what is in the curriculum not otherwise. All respondents explained that they teach according to CAPS requirements. For example, Thuliswa expressed:

"Here there is no time to look on what children know before they come to class. I am guided to teach as planned in CAPS. There is time allocation for every lesson; I need to finish up the syllabus as required. The curriculum does not cater for accommodating what we think children know."

Likewise, Bulelwa had this to say:

> *"Yho, there is too much confusion in the curriculum, it has been amended many times, now involving grandmothers can be a difficult task, we are not yet competent ourselves, there is too much to do and we do not have time. We need to finish up the syllabus because children must write the common paper".*

Jessica, on the other side noted:

> *"I do acknowledge that children come to school with prior knowledge, but I am not sure of how it can be used in teaching mathematics. Looking at children's mathematics performance, any intervention is welcome, if this can work then we need to use it."*

All teachers reported a challenge sometimes when they teach using the CAPS textbooks. Bulelwa shared:

> *"It is difficult to become sensitive when we teach because all children use one textbook per subject. I was faced with the challenge to explain some of the illustration in the textbook. I could not find anything related to children's everyday life to an extent we decided to scratch off that activity from the textbook"*

The data revealed that Grade 2 teachers are underpinned by the monoculture views rather than Pragmatism approaches to education. These teachers reported that they teach children with preconceived notions of the CAPS. This data revealed that children' social and cultural resources were often not accommodated by teachers in the classroom or by parents at home. It transpired from the data that teachers omitted children's social capital and funds of knowledge. Through the omission of multicultural understanding, schools have become monoculture environments (Christianakis, 2011). Monoculture can be defined as a practice of actively preserving a national culture via the exclusion of external influences (ibid). It can also mean a society with a common heritage, belief, structures, usually mono-racial identity; one that tends to look inward than outward. These finding are in line with

(Moloi, 2006) who indicated that curriculum prescripts have eroded family engagement and connections with school personnel has been compromised. This lack of understanding what grandmothers do will continue to create a divorce between mathematics at home and mathematics at school (Tatira, Mutambara, & Chagwiza, 2012).

4.3.3.3. Joint responsibility but reluctant partners

This section presents findings on grandmothers and Grade 2 teachers' opinions of their partnership with schools. Surprisingly, both grandmothers and Grade 2 teachers consider each side dependable to the other upon home-school collaboration. The respondent's opinions varied regarding their roles in building good home-school relationships in collaborating grandmothers in their children's mathematics learning. All teachers seemed to indicate their roles as including taking the lead in involving grandmothers' whilst grandmothers seemed to understand that it is their primary responsibility to work with schools for the benefit of the success of their grandchildren. Teachers asserted:

Bulelwa:

> *"So in short, I think supposedly teachers are to team up with all parents and brief them on why it is important to help the child in the learning of mathematics or other subjects. But, because of the load of work we have we are not able to do that"*

Thuliswa echoed the same sentiments when she noted:

> *"I think we need to work with parents to get their active participation in their children's mathematics learning. If the children get home and they don't get the support from parents, then it becomes very hard"*

Jessica (T3) reported:

> *"As much as we have term planners and monthly workshops where we workshop all parents, I think it is important that we look in this issue of grandmothers as a different case, because in reality we need*

all parents to be involved in improving the mathematics performance of children. It is evident that we as teacher alone cannot be able to change this situation"

Grandmother's echoed the same sentiments when they claim that "the success of these children is our pride, for them to be successful, it cannot be that we give the schools all the responsibility to educate our children." For instance,

Tozi recounted,

"I want my granddaughter to be successful, so it my responsibility to have a good relationship with her teachers so that I know where can I help her".

Most of the grandmothers reported that they wish to get involved in their grandchildren's mathematics but they expressed different views on how. For example,

Sapho noted that,

"We do know that children's success is our pride; the only problem is school need to listen, I want the schools to not jump to conclusions so fast, keep an open mind and listen to what grandmothers are saying. I once told them they must not treat us the same as other family structures, we need to be constantly reminded of what we need to do. I voiced my opinion about not having something for the grandmothers at the school because I know was not the only one who is raising my grandchildren. They responded and now there is grandparents' day. It was unorganized but, I hope it will get better"

Likewise, Vuvu expressed:

"Schools should notice and realize that the family is going through a transition, we need them to be patient and maybe offer some type of

support. These grandchildren are going through a lot of rough times. They need counselling not pressure. We are going through a rough time as well. Mathematics is not the same as it was when my kids or I went to school. As grandmothers we need some type of training to help support these kids. The school should offer some kind of tutoring to meet their deficient in their reading and mathematics, we are very much concerned. As grandparents, we cannot always afford to make that happen without their help."

Some grandmothers felt they did not have easy or ongoing access to their grandchildren's teachers and that teachers blamed grandmother when children had problems in school. Kholi reaffirmed what other grandmothers have reported:

"Teachers need to understand where our grandchildren come from. I remember I was once called by her teacher and she said that my granddaughter had an anger problem, the next day she was shifted to another classroom. I felt they should have not moved her out of the classroom. The principal should have made my granddaughter apologies to the teachers and let her back to the classroom. They moved her into the other classroom and her behaviour became worse. I decided to go to school about this, and I overheard the new teacher telling the other one, that do not worry I will deal with her"

Sapho emphasizes:

"Schools must take time to listen to us, I think they see us but do not hear us. I think teachers need to understand what these children are going through instead of handling them the way they do. They must pray for them and have compassion, communication is a one-way system, only schools send out information but we do not have opportunities to send any ideas"

These findings project Epstein's view of (2011b) which argues that mathematics teachers who are knowledgeable of and understand the changes in mathematics content, pedagogy and assessment are privileged to take part in various activities

central to mathematics education and reform thereof. Parents, on the other hand, are not privileged to participate in many of the same activities mathematics teacher perform (Remillard & Jackson, 2011). Furthermore, parents, because of their incomplete knowledge of this true discourses, are unable to engage in various activities that are part of mathematics education (Epstein, 2011b). This implies that teachers should be the driving force of parent-educator partnership in improving children's' mathematical skills.

4.4. Summary

In conclusion, this chapter presented the study's findings obtained through individual shadowing and interviews. In this chapter, various opinions on various themes drawn from the main questions, as indicated in the introductory section chapter, were demonstrated. Grandmothers' provided an insight full description of their roles regarding their grandchildren upbringing and mathematics education. The data further revealed that mathematics was put into use through different categories of home- based activities that grandmothers engage with their Grade 2 grandchildren

Chapter 5

Summary, conclusion and recommendations

5.1. Introduction

The purpose study was to find the home activities to promote mathematical skills of Grade 2 foundation phase learners. Having identified the sample of the study's focus, in particular is the step towards recommending what grandmothers and Grade 2 teachers can promote mathematical skills of Grade 2 Foundation Phase learners. Based on the data given and the main findings: this chapter contains a summary of the research findings as well as implications for practice for Grade 2 learners, teachers and grandmothers under study. Suggestions and recommendations for future research sum up this section of the research report.

5.2. Summary of the study

The summary includes key themes on the conceptual and practical approach to the promotion of Grade 2 Foundation Phase learners' mathematical skills.

5.2.1. Their perception of roles

From research question one, the perceptions reported by the participants on their understanding of their role to their grandchildren's mathematics education extracted were:1) Grandmothers perceive their role as caregivers and or surrogate parent; 2) Grandmother views their role as protectors; 3) Grandmothers role as home-based teachers (Mudavanhu, 2008; Schrijenis & Smit, 2014). All six grandmothers interviewed framed themselves as being caregiver and or surrogate parents, protectors and home-based teachers. However, these roles did not appear to be enough for promoting children' mathematical skills. Therefore, I now turn to a discussion of the themes.

5.2.1.1. Grandmothers as caregivers

The data revealed that all grandmothers confirm that they see themselves as primary care givers to their grandchildren.

- Grandmothers reported about the whereabouts of their grandchildren's biological parents, some reported that their parents were teenagers who are still at school whilst others reported that they are working. Two other grandmothers reported that biological parents of their grandchildren passed away. The latter reported that they are mothers their grandchildren never have. The description seems to concur with (Schrijenis & Smit, 2014) who refers to a caregiver is an individual who acts in place of the legal parent to make decisions about the child when no parent can be located or identified.

- All six grandmothers interviewed reported that they ultimatum goal is to be primary caregivers to the grandchildren. The findings revealed that most grandmothers seem to understand that children's right are too important to be ignored however, these perceived roles are not enough regarding promoting children's mathematical skills (Mudavanhu, 2008).

5.2.1.2. Grandmothers as protectors

Protection slightly differed from providing in that is a role to which majority of grandmothers reported to be undertaking. All grandmothers reported to view their role as protectors of their grandchildren in order for them to be successful in life. Majority of grandmothers recalled from their own childhood experiences and narrated their feelings of being neglected in their own childhood.

- Majority of grandmothers expressed that they protect their grandchildren from emotional harm. For example, they will visit school immediately as they see their grandchildren hurting emotionally. These grandmothers' perception is influenced by their own childhood experiences and by fact that some of their grandchildren do not have parents some see their parents once in a while.

- From the data, it transpired that grandmothers also protect their grandchildren from the violence that happened in our neighbourhood, and that they have to make they are always safe and grow up knowing what is wrong and right. These grandmothers' emphases on the importance of making sure that their grandchildren go to church so that they can develop good morals and to fear God. All grandmothers strongly believe that if their grandchildren fear God they will then be able to do things right and in that way they will always be safe.

- Approximately half of grandmother respondents conveyed a different view of protecting their grandchild, Khamo and, Sapho noted, they have to protect their grandchildren's from intellectual harm. These grandmothers reported that they to monitor what their grandchildren watch on TV and the time they spent watching the TV. These grandmothers believed that some of TV programs my hinder cognitive development and intellectual development of the child.

From the data, it transpired that these grandmothers do not only view their role as protectors but also as source of social support to their grandchildren. The importance of this kind of involvement that grandmothers provides is as confirmed by (Melhuish, et al., 2008) who discovers that every person-to-person interactions literally shapes the human brain and that the more important the relationship the more profound the effect of these interactions on brain development.

5.2.1.3. Grandmothers as home-based teachers

Grandmothers as caregivers to their grandchildren reported that their also perceive their roles as first educators of their grandchildren and therefore the most important and influential persons in a child's life (Al-Mahdi, 2009). All grandmother respondents revealed that they enhance their grandchildren's interest of mathematics through different ways.

- Provide their grandchildren with resources and material that provide them with opportunities to practice mathematics.

- Some reported to perceive their role as coach for their grandchildren through daily activities and home works to build their children's mathematics competency

- Initiate conversations that evoke mathematics as they watch TV and reading newspaper

- Pose problem- solving questions as they engage in activities with their grandchildren

5.2.2. Home-based activities

One striking feature of grandmother's home activities they engage with their Grade 2 grandchildren was the diversity of mathematics applications they contained. All grandmothers reported that they engage their Grade 2 grandchildren in a variety of activities. From the data it emerged that grandmothers engage in three types of activities that include 1), Everyday activities; 2) Special chores; 3) Games, Fun, Games and Playful activities. About half of these activities emerged as families were resolving problems that presented some difficulty. From the interviews it transpired:

- The first type of activities such as special projects accounted for about one third of activities focused on routine task that families engage in on a daily basis. Some of these activities were context relevant whilst some were financial related. These activities included cooking and baking, laundry, cleaning, gardening and landscaping, sewing, herding animals, fetching water from the river or community taps, fetching wood amongst others.

- A second type of activities mathematics was put to good use across a variety of important and valued activities, from measuring for home improvement, to budgeting, to figuring out the best value while shopping, to deciding which shop to buy in.

- In other cases, mathematics was put to use playfully, in games and puzzles, where the problems needing solving were invented for fun.

Across these examples, mathematics was embedded in solving problems that mattered to grandmothers, with the problems themselves driving the activities. Diverse kinds of mathematics emerged from these activities. It transpired that they created and maintained spreadsheets and they used calculators and computer applications. They rounded and estimated, worked with ratio, and proportions, thought in two-and three- dimensions, and worked with patterns, geometrical shapes.

5.2.3. Interplay of home activities and grade 2 mathematics

Data from research question three, extracted the following sub-themes 1) Encourage correct use of language of mathematics and increase number vocabulary of children; 2) Reinforce numbers and what numbers mean;3) Extend problem solving skills; 3) Reinforce shapes recognition and spatial relationships; 4) Complement matching, classifying and sorting skills; 5) Reinforce measuring time; 6) Playing games reinforces mathematical concepts.

5.2.3.1. Correct use of the language of mathematics and increase children's number vocabulary

From data it became evident that home activities grandmothers engage their Grade 2 grandchildren encourages the correct use of language of mathematics and increase in children's numbers vocabulary:

- As grandmothers read the instruction with them, the correct use of the language of *fractions* and *measurement* is increased and number vocabulary is also developed as grandmother's talk during the cooking activity. Fractions. Measurement technically is finding length, height, and weight of an object using units, feet or hands. Grade 2 grandchildren were using cups, teaspoons and table spoons to measure ingredients.

- This occurred as grandmothers were using mathematics vocabulary with and around their grandchildren**.** Through financial activities was common to all

grandmothers' "children see name coins and notes when out shopping". Similarly, all grandmother confirmed to be cooking and baking with their grandchildren "Talk about measuring tools when cooking or even when measuring objects around the house.

- From the data it transpired that when grandmothers are driving or walking with their grandchildren they use directional words, such as right, left, or *straight.* Likewise, as well as they watch TV and read newspapers with their grandchildren, all grandmothers share comparing prices from shop to shop. During shadowing, they were cases also where grandmothers used words that relate to time such (before, after, next, later), measurement (empty, full, rand, metres, centimetres, etc.), and position (under, on, above, etc.)

Finally, it helps children follow instructions, such as carry on, start from, put, and place, what comes next? A strong sense of numbers, and how they are used, will enable children to understand place value, e.g., that the number "256" consists of two groups of one hundred (200), five groups of ten (50) and six ones (6), as required in grade 2. Understanding place value is necessary in learning mathematics as it precedes solving complex addition, subtraction, multiplication, and division problems. Therefore, it is evident that home activities grandmothers engage their grandchildren at have a capacity to promote Grade 2 mathematical skills.

5.2.3.2. Reinforce numbers and what numbers mean

The data also revealed that these home activities reinforces numbers and the meaning of numbers to Grade 2 learners. Data revealed:

- During the cooking activity counting skills are also enhanced as grandmothers' cook and bake with their Grade 2 grandchildren, for example, counting the amounts of each ingredient being used in recipes; counting the numbers of items being made such cupcakes et., reading the number off the recipe and then count the cups or spoons required; count the cutlery when you are setting the table.

- Through cleaning and packing groceries extend position and orientation skills such as on top of, top, bottom, side, forwards, backwards, over, under, in front, behind, next to, between, roll, turn, stretch.

- Moreover, setting the table activity emerged in most households, this help Grade 2 learner reinforce one-to-one correspondence; each person gets one plate, one fork, one napkin, one cup, etc.

- Further, the data also revealed that these home activities reinforce numbers and the meaning of numbers to Grade 2 learners. Moreover, it is further shown that home activities extend children's problem solving skills.

Through shopping and weighing of grocery products- Grade 2 grandchildren learn to weigh fruits, meat and vegetables at the grocery store and estimate the cost (Ginsburg, Lee, & Boyd, 2008). Let them pay the clerk in the store and then count money to ensure it's the correct change, children about volume.

5.2.3.3. Reinforce shape recognition and spatial relationships

Mathematics can be seen as painting without using the brush, and painting as mathematics without the chalk. As children were packing they were not only exposed to number operations (addition and subtraction), and relationships but also in patterns and shapes such as flat, round, circle, square, triangle, rectangle, and star. Some of the art portraits present three-dimensional forms on two-dimensional picture surfaces, even curved ones, cylinders, triangles, squares, and rectangles as required.

Secondly, mathematics is the science of pattern and painting is articulation through patterns. Findings from this study revealed grandmother-headed holds does have and this was the case in Khamo and Thando households, where wall painting and different art portraits were observed. These artefacts showed trends of patterns it their designs.

Also as grandmothers were sewing and beading with their grandchildren such designs show a various patterns that were to be followed.

5.2.3.4. Compliment matching, classifying and sorting skills

- By grouping children identifies a common feature to form a group, so separate from another groups.
- Classification is important to learning to organize knowledge ideas. Children need to learn to discriminate differences, to reason and analyses, and select items to form groups.
- Matching the child can learn identify which items are the same and which are different. The ability to discriminate differences is important to all sorts of learners not just mathematical concepts, for example, learning to recognize the difference between similar letters (b + d) is important to learners to read and write.
- Comparing the child is learning to look more at colour, size, shapes, patterns and number of items in order to compare items or groups of items, because children learn to look closely at similarities and differences two different items or groups of

5.2.3.5. Reinforce measuring and time

- Cooking and baking also provides Grade 2 children with plenty of opportunities to do some “estimation”. Estimation is the ability to make a good guess about the amount or size of something. *For example,” increasing and decreasing”: as Thando asked Sona to put salt at the palm of his hand to see if it will enough for his beef stew he was cooking.* From this data it was revealed that Grade 2 grandchildren were encourage to “measure” objects using non-standard units such as spoons, and cups to estimate.

- Through packing groceries Grade 2 grandchildren had to carry a 1kg bag of sugar to feel how heavy it is. Packing activity can develop their estimation skill, as they carry other packages they will compare the weight to that of 1kg sugar.

- Having to carry water, children use measurable container that lead to exploring the relationships between volume of water, and its weight. Having to balance on the head without hands support, and sometimes these women put leaves on the open top of the bucket to minimise splashing of water. This procedure teaches Grade 2 learners balancing and problem-solving.

- Herding cattle can be used to teach children counting and the concept of time. Concept of time is fostered when children have to know the exact times to take the livestock out of and into the kraal.

5.2.3.6. Playing games reinforces mathematical concept

Finally, the data revealed that mathematics could be part of family fun.

- *Ugqaphu* or rope skipping is often played by children. However, it transpired from the data that even though these children were playing, *ugqaphu*, they were not aware that it contains mathematics. By these learners are taught counting skills, balancing and speed since they must adjust to the speed of the revolving rope. As they skip, they will be counting, and sometimes compete to see who would skip the highest count.

- In a game of *upuca*, children throw a flat stone which they push with one from one box to another while balancing on one leg. Sometimes instead of rectangular boxes they use circles, which help learners develop the sense of shapes. The counting system is developed every time a player plays since they have to remember where they ended and where to start the next time. The concepts of mass, weight and balancing are also perfected in the process.

- *Umlabalaba* game is played by two people each with twelve identical objects, different from the opponent's. Players strive to block the opponent from forming a row, diagonal or column of three stones. If such a row is formed, an opponent's strategically placed piece is taken off the game. This goes on until one player's objects are finished. Sets,

counting, symmetry, geometrical shapes, ratio, proportion and logical reasoning are some of the skills duly developed through the playing this game.

- *Imizi* or mud house play in English, is where children use mud to bake cakes using different shapes and sizes of containers available. The cakes are dried in the sun and figuratively eaten thereafter. Sometimes roles of family members like father, mother, daughter and son are modelled to make the activity livelier. A multitude of mathematical skills are developed, for example, volume, measuring length and identification of solid shapes during their modelling

- *Udongwe* or clay toys is an activity which see children designing different solids, animals and other things from wet clay. The objects are dried in the sun to make them firm and permanently hard. Children learn the skill of volume, shapes, measurement and patterns

- *Iimoto zamacingo* or wire cars are made by young boys as toys, and which requires great skill. This teaches learners about measurement, length, symmetry and shapes.

In sum, mathematics in the home was used to help with some problems that were routine and some that were unusual, some that were simple and some were complex. Most of these activities portrayed successful problem-solving

5.2.4. Parent-educator partnership

From research question four, four sub-themes emerged, teachers do not how to involve grandmothers; 2) Curriculum prescripts not supporting nor acknowledge learners' social capital; 3) Joint responsibility but reluctant partners.

5.2.4.1. Teachers do not know how to involve grandmothers

- Both Grade 2 teachers and grandmothers confirm that the promotion of mathematics is a complex task that involves many role players with

overlapping responsibility however, teachers reported that they do not know how to involve gradmothers in their grandchildren's mathematics.

- Grade 2 teachers do understand the expectations of curriculum
- Not attending school meeting by grandmothers gave Grade 2 teachers a perception that they do not care about their grandchildren and mathematics education.
- While teachers highlighted that grandmothers may not understand mathematics, there was, however, no evidence that the schools made any effort to stimulate grandmother's ability to promote children's mathematics.
- In contrast grandmothers believed that they fulfilled their roles

5.2.4.2. Curriculum prescripts not supporting nor acknowledging learners' social capital

An interesting finding was revealed by the data, where Grade 2 Teachers reported that they teach what is in the curriculum not otherwise.

- All respondents explained that they teach according to CAPS requirements the data revealed that Grade 2 teachers are underpinned by the monoculture views rather than Pragmatism approaches to education.
- All teacher participants reported that they teach children with preconceived notions of the CAPS.
- This data revealed that children' social and cultural resources were often not accommodated by teachers in the classroom or by parents at home.

- It transpired from the data that teachers omitted children's social capital and funds of knowledge. Through the ommission of multicultural understanding, schools have become monoculture environments (Christianakis, 2011). Monoculture can be defined as a practice of actively preserving a national culture via the exclusion of external influences (ibid). This implies that South African education system is like a schools view students as learners with a common heritage, belief, structures, usually mono-racial identity; one that tends to look inward than outward. These finding are in line with Moloi (2006) who indicated that curriculum prescripts have eroded family engagement and connections with school pesronnel has compromised.

- The data further noted that the lack of understanding of what grandmothers by Grade 2 teacher will continue to create a dirvorce between mathematics at home and mathematics at school (Tatira, Mutambara, & Chagwiza, 2012).

5.2.4.3. Joint responsibility but reluctant partners

Surprisingly, both grandmothers and Grade 2 teachers consider each side dependable to the other upon home-school collaboration. The respondent's opinions varied regarding their roles in building good home-school relationships in collaborating grandmothers in their children's mathematics learning. All teachers seemed to indicate their roles as including taking the lead in involving grandmothers' whilst grandmothers seemed to u understand that it is their primary responsibility to work with schools for the benefit of the success of their grandchildren.

The findings concur with that of Moeller and Blelfelt (2011) who found that teachers perceive children raised by grandmothers as likely to occupy substantial amounts of school personnel time, further suggesting if teachers must spend much of their day focusing on the needs of these grandchildren, they will have less time to see the academic and behavioural needs of other students. School personnel need a clear sense of their own ethnic and cultural identities in order to understand these of their students and families (Moeller & Blelfelt, 2011). The danger of obtaining knowledge

about specific cultures or family structures is it increases chance that school personnel will unintentionally act in inappropriate ways (ibid).

5.3. Conclusion

This study was embarked on to find out what home activities grandmothers engage their Grade 2 grandchildren to promote mathematical skills of Foundation learners with The purpose was achieved through interview and shadowing and literature review. All grandmother participants confirm to engage their Grade 2 grandchildren into a variety of home activities but some were not aware that what they were doing contained magnitude of mathematical skills. They are engaging in these activities thinking they are solving their own everyday activities. What they do yielded good results. The Grade learners were exposed to a variety of opportunities that contained an application of mathematics. Grade 2 teachers, even though they confirm that they do not know how to involve grandmothers, they acknowledge the importance of understanding children social capita knowledge. They blame the education curriculum education system for not supporting and acknowledging learner's social capital. Both teachers and grandmothers concur that mathematics education is the responsibility of all stakeholders involved. All participants said the lack of Department of Education guiding document to involve grandmothers is a biggest challenge in forming an effective partnership.

5.4. Implication of theory

Mathematics education is an established area of study which comprises various research trends and theoretical perspectives. These trends rest on different philosophical assumptions derived mainly from both mathematics science and education disciplines as well as other subjects such as philosophy, psychology and sociology.

The philosophy of mathematics focuses on the philosophical assumptions and implications of mathematics. Ernest (1994) suggested that there is a strong link between mathematics philosophy and mathematics education because explicit or implicit philosophical notions can have significant impact on mathematics teaching

and learning practices. He distinguishes between two main philosophical approaches: the absolutist approach, which conceives mathematics as a universal knowledge, value- and culture-free; and, the fallibility approach, which considers mathematics as an outcome of social processes. According to Ernest (1994:10) “social and cultural issues cannot be denied legitimacy in the philosophies of mathematics and must be admitted as playing an essential and constitutive role in the nature of mathematical knowledge.” Therefore, this view has brought with it the implication that mathematics educators should pay more attention to the different contexts of learning and their social and cultural characteristics (Bayanga, Mtose, & Quan-Baffour, 2010). This shift in the philosophical perspectives has become central to a variety of contemporary mathematics learning theories including the pragmatic theory.

The pragmatic theory, inspired by the work of Dewey, has developed a new conceptualisation of how people think and act. Pragmatism believes knowledge results through interactions (action or doing). Therefore, the findings of this study conform to pragmatism theory, as grandmothers interacted with grandchildren mathematical knowledge was transferred to Grade 2 learners. This knowledge occurs through: (1) social interactions which occur as Grade 2 learners interact with their grandmothers as they engage in in household chores. By implication, this means that learning by doing is important for developing strong knowledgeable base among learners, and, (2) resources and tools where cultural and psychological tools such as language, number systems, signs, and artefacts can play key role in the way people organise, process, and remember information.

Tatira, Mutambara, & Chagwiza (2012), for example, pointed out that Dewey’s ideas of developing knowledge by practical cultural tools and social interaction can have significant mathematics education implications and applications. First, each cultural context can have its own set of cultural tools and situations where these tools can be appropriated for promoting mathematics. This was revealed in the findings of this study when it emerged from the data that grandmothers use measurable items such as calendar when plaining family events, tape measures when sewing, food scale and measuring spoons as they cook and bake.

Dewey's idea advocates that learners should not be taught dead facts and theories because these may not help them to solve the problems of life. Again, this idea is congruent with the assumptions of this study that education is to prepare the child for a successful and well-adjusted life; therefore, mathematics should not be divorced from children's everyday life.

Secondly, Dewey's idea of learning through social context contributed to the development of a new approach which conceptualised learning as a "forum in which people can talk how to fulfil their needs, which beliefs work to get them what they want, without running into Platonic impasses." Rorty (1985) argued that this participatory approach has challenged the acquisition model of learning which viewed learners as containers to be filled with knowledge and skills through teachers' instruction.

5.5. Recommendations of the study

The implications of this study on the educational context in Bahrain can be summarised as follows:

- Teachers should seek parents' help and support and build upon parents' experiences and knowledge. Parents of all different social, cultural, and educational backgrounds should be involved in their children's education and there should be seen as holding different experiences and knowledge and not deficient. Their knowledge and experiences should be identified, acknowledged and utilised in school learning processes. Teachers should exchange their knowledge with parents' knowledge in a two-way mutual manner. Teachers should also learn more about their children's characteristics, out-of-school activities, and their social, cultural and educational backgrounds. Schools should encourage hard-to-reach parents to be more involved through identifying their needs and concerns and building upon their resources instead of viewing them as deficient.

- Teachers should also learn more about how parents teach their children at home, and provide parents with more information about how mathematics is taught in school. Teachers should learn more about the importance of children's participation in different social interactions, the different cultural tools they used in their everyday life activities, and the values which they associate with certain cultural tools in certain social contexts.

- Teachers and school administrators should provide more opportunities for parents and grandmothers who belong to different social, cultural, educational backgrounds to be involved in school-centred parental involvement activities (e.g. communication, decision-making, volunteering etc.) and also recognise and build upon home-centred parental involvement activities such as utilising parents' close relationships with their children and their shared engagement in authentic out-of-school practices

- The Department of Basic Education in South Africa should work more on developing policies and initiatives which encourage stronger home-school relationships. They also should encourage more collaborative or action research work in schools in order to learn more about the students' and their families' funds of knowledge and utilise this knowledge to extend and enrich children's learning in school. The Department of Basic Education should also organise more in-service and pre-service training for their teachers in the area of home-school relationships and in learning in different contexts.

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Appendices

Appendix A: Ethical Clearance Certificate

University of Fort Hare
Together in Excellence

ETHICAL CLEARANCE CERTIFICATE
REC-270710-028-RA Level 01

Certificate Reference Number:	DUK211SHLU01
Project title:	**Home activities grandmothers' engage their Grade 2 grandchildren to promote mathematical skills.**
Nature of Project:	Masters
Principal Researcher:	Nolukholo Faith Hlungulu
Supervisor:	Prof N.S Duku
Co-supervisor:	N/A

On behalf of the University of Fort Hare's Research Ethics Committee (UREC) I hereby give ethical approval in respect of the undertakings contained in the above-mentioned project and research instrument(s). Should any other instruments be used, these require separate authorization. The Researcher may therefore commence with the research as from the date of this certificate, using the reference number indicated above.

Please note that the UREC must be informed immediately of

- Any material change in the conditions or undertakings mentioned in the document
- Any material breaches of ethical undertakings or events that impact upon the ethical conduct of the research

The Principal Researcher must report to the UREC in the prescribed format, where applicable, annually, and at the end of the project, in respect of ethical compliance.

Special conditions: Research that includes children as per the official regulations of the act must take the following into account:

Note: The UREC is aware of the provisions of s71 of the National Health Act 61 of 2003 and that matters pertaining to obtaining the Minister's consent are under discussion and remain unresolved. Nonetheless, as was decided at a meeting between the National Health Research Ethics Committee and stakeholders on 6 June 2013, university ethics committees may continue to grant ethical clearance for research involving children without the Minister's consent, provided that the prescripts of the previous rules have been met. This certificate is granted in terms of this agreement.

The UREC retains the right to

- Withdraw or amend this Ethical Clearance Certificate if
  - Any unethical principal or practices are revealed or suspected
  - Relevant information has been withheld or misrepresented
  - Regulatory changes of whatsoever nature so require
  - The conditions contained in the Certificate have not been adhered to

- Request access to any information or data at any time during the course or after completion of the project.

- In addition to the need to comply with the highest level of ethical conduct principle investigators must report back annually as an evaluation and monitoring mechanism on the progress being made by the research. Such a report must be sent to the Dean of Research's office

The Ethics Committee wished you well in your research.

Yours sincerely

Professor Wilson Akpan
Acting Dean of Research

22 September 2016

Appendix B: Buffalo City Education District Permission

Province of the
EASTERN CAPE
EDUCATION

BUFFALO CITY METRO DISTRICT

OFFICE OF THE DISTRICT DIRECTOR
DR WB Rubusana Building,NU 1 Mdantsane,East London,5200 SOUTH AFRICA Tel: 043 708 6210 Fax :043 760 0545,
Website:www.ecdoe.gov.za ,Email:welekazi.dantile@ecdoe.gov.za

DATE: 16 MAY 2017

Ms Nolukholo Faith Hlungulu

50 Church Street

EAST LONDON

5201

Dear Ms Hlungulu

REQUEST FOR PERMISSION TO CONDUCT RESEARCH IN SCHOOLS IN THE BUFFALO CITY METRO DISTRICT

Approval is hereby granted for you, **Ms Hlungulu**, to conduct research, with the topic ***"Home activities grandmothers engage their grade 2 grandchildren to promote mathematical skills"***, as part of your study towards the Masters Degree qualification at the University of Fort Hare.

This permission is granted provided that you make proper arrangements with the affected school principals and to ensure that tuition time is not disrupted.

We wish you well in your endeavours.

Yours faithfully

.....

E. KLAASEN – DISTRICT DIRECTOR

building blocks for growth

PGDP

Appendix C: Interview questions

Good morning. I am Hlungulu Nolukholo Faith, a Master of Education student at UFH. As indicated earlier on I am conducting this study as part of my Master of Education degree in which I seek to explore home activities grandmother engage their grandchildren to promote mathematical skills of Foundation Phase. Feel free to respond to my questions and let me know in instances where the question is not clear.

Section One

Research Instruments

Shadowing schedule- out of the household shadowing- interactions and relationships amongst grandmothers', grandchildren and household learners/ what activities do they do together/ beliefs/ household traditions / environment that influences mathematics learning/ printing material within the household/ travelling activities/ family events/ grandmothers and other siblings attitude in relation to schooling/ negative and positive discussions-who says what/ cliques and groupings/ common discussions amongst the household/relationships with grandmothers-community-etc/improvements and family development- who initiates-who get involved/ state/upkeep and utilisation of the household environment and the infrastructure/movement patterns of grandmothers', other siblings/when family get together/ what do they talk about/ what do grandchildren talk about.

a) Interview schedule: open –ended question

The goal of this interview is to explore a wide range of home activities grandmothers engage their grandchildren that may promote their mathematical skills.

Section Two

Biographical Information of Grandmothers

Please tell me more about yourself with special reference to the following information:

1. How old are you?
2. Your highest level of qualification?
3. What is your source of income?
4. How many grandchildren live under your care?
5. Are they going to school?
6. Which grades are they studying?
7. For how many years have you been staying with your grandchild/ren?
8. Do you receive any form of support (financially and socially) support from raising your grandchild? If yes from whom?
9. Who else are staying with?

Research Question 1: What home activities do grandmothers use to promote mathematical skills of Grade 2 Foundation Phase learners?

1. Kindly describe your typical school day?
2. At what time do you and your children wake up during the week and on weekends?
3. On weekends, Saturday and Sunday what is your typical day?
4. What activities do you and your grade 2 grandchild enjoys doing?
5. How do you know?

Section Three

Research Question 2: What are the grandmothers' perceptions of their role with regard to their grandchildren's mathematics education?

What role do you play in raising your grade 2grandchild/ren?

1. How do you feel of the role you play?
2. Why do you feel that way?

3. Did you do mathematics when you were still at school? Were you good or bad?
4. Did you enjoy mathematics at school?
5. Why so and why not so?
6. Please explain what influenced your mathematics learning? And how?
7. Is/ Was your career related to mathematics?
8. Do you perhaps think that it is important for your grandchildren be exposed to mathematics in their everyday life?
9. What role do you play to encourage mathematical learning in your home?
10. How do you feel of the role you play?
11. Amongst your grandchildren, the one in Grade 2 in particular, what does /she/ he studies from school?
12. Make a comparison with others, are you involve in her/his/their mathematics education, how and why?
13. What challenges do you experience with regard to assisting your Grade 2 grandchild/ren mathematics?
14. Which support systems are available in your household or your Grade 2 grandchild/ren's school, to enable you promote your grandchild/dren mathematical skills?

Section Four

Research Question 3: How do home activities promote Grade 2 mathematical skills?

1. Do you list the grocery items with your Grade 2 grandchild/ren?

2. Who does the stock take of groceries?

3. Do you draw budget with your Grade 2 grandchild/ren?

4. Who weigh items such as fruit and vegetable when shopping?

5. Do you cook and bake with your Grade 2 grandchild?

6. Do you lay the table with your Grade 2 grandchild?

7. Are there any animals in this household? If yes. Do your grandchildren assist in looking after those animals?

8. Do you do laundry with your Grade 2 grandchild/ren and who is the sorting of clothing?

9. Do you do gardening with your grandchild/ren?

10. When doing gardening do you make plots for each plant?

11. When painting you house which colours do you like?

12. What shapes do like when landscaping your yard?

13. Does your Grade 2 grandchild know all the amount of ingredients he/she need to make you tea/ coffee?

Section Five

Research Question 4: How do Grade 2 teachers interact with grandmothers to promote mathematical skills?

- Describe the school you are employed?
- Which quintile is your school?
- What is the school's language of teaching and learning?
- How long have you been teaching?
- How long have you been teaching grade 2?
- What teaching qualification do you hold?
- Any other qualification?

- Why do you teach Grade 2?
- Which subject do you enjoy most? And why that subject?
- Do you like mathematics?
- What do you consider to be your role in involving parents in their children's education?
- How have you come to this understanding of your role?
- On average how many children raised by grandmothers' in you class?
- Are there any mathematical challenges or successes these children experience compared to children raised in other family structures?
- How different are those challenges or successes compared to children's that are raised by other family structures?
- Can you describe your practices of involving grandmothers to their grandchildren's mathematics education?
- How do you seek to assist grandmothers to make mathematics practical and part of their lives?
- Does your school offer any support grandmothers with regard to mathematics education of these children?

Appendix D: Letters

Flat 11 Towerhouse
Caxton street
East London
5201

Dear Sir (EDO)

RE: REQUEST FOR PERMISSION TO CONDUCT RESEARCH IN THE SELECTED SCHOOLS IN EAST LONDON DISTRICT

I am a registered M. Ed student at the University of Fort Hare. My student number is 201213965

The purpose of my study is to explore home activities grandmothers engage their Grade 2 grandchildren to promote mathematical skills.

I will be grateful if you can allow me to conduct research in the selected schools that are in your district. The research participants would be Grade 2 teachers.

Should you have any concerns about the study please do not hesitate to conduct my supervisor Prof N. Duku on 043 704 7222. Confidentiality with regards to data collected will be highly observed. Thanks in anticipation.

Yours faithfully

Hlungulu Nolukholo Faith- (0834987249)

Flat 11 Towerhouse
Caxton street
East London
5201

Dear Parent

RE: REQUEST TO INVOLVE YOUR CHILD AS A RESEARCH PARTICIPANT IN A RESEARCH STUDY

I am a registered M. Ed student at the University of Fort Hare. My student number is 201213965

The purpose of my study is to explore home activities grandmothers engage their Grade 2 grandchildren to promote mathematical skills.

I will be grateful if you can allow me to conduct research in the selected schools that are in your district. The research participants would be Grade 2 teachers.

Should you have any concerns about the study please do not hesitate to conduct my supervisor Prof N. Duku on 043 704 7222. Confidentiality with regards to data collected will be highly observed. Thanks in anticipation.

Yours faithfully

Hlungulu Nolukholo Faith- (0834987249)

Flat 11 Towerhouse
Caxton street
East London
5201

26 September 2016

Letter to the principal

Name of School:
Dear Principal/ School Governing Body

Permission to conduct a study in your school

My name is Nolukholo Faith Hlungulu I am a research student at the University of Fort Hare Completing Master's Degree in Education (M. Ed) in the Faculty of Education. I am looking for a Grade 2 teacher/s from your school to participate in the research study. The purpose of the study is to explore home activities grandmothers engage their Grade 2 grandchildren to promote mathematical skills. The purpose of this is to assist grandmothers and Grade 2 teachers recognise possible connections between the formal curriculum (mathematics) and home based mathematics.

Participation in this study is voluntary and teachers may withdraw at any time. I will keep the identity of teachers as well as your school anonymous. The data collection methods will include shadowing and individual interviews. The results of this study will be published in the form of a thesis and the collected data will be kept confidentially and will only be shared with my supervisors.

There are no risks involved in the study and participants will not be financially compensated. I will also ensure that I respect the teacher's constitutional rights for dignity as well as ensuring that they are not harmed in any way through this research.
Teachers will be given ample opportunity to ask questions about the study. I will also discuss the final result with you in the form of a feedback. The findings of the inquiry may also be presented at conferences, as well as appear in books or articles, where the teachers' names will be kept confidential.

Yours sincerely

Nolukholo Faith Hlungulu

Prof N. Duku (Supervisor)

Appendix E: Research Ethics Application

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UNIVERSITY RESEARCH ETHICS COMMITTEE
APPLICATION FOR ETHICAL CLEARANCE: HUMANS

Please indicate (x)

New application	X
Re-submission	
Renewal application	

SECTION 1: DETAILS OF APPLICANT/PRINCIPAL INVESTIGATOR		
Name: NOLUKHOLO FAITH	**Surname:** HLUNGULU	**Professional Status:** STUDENT
University Division / Faculty and Department: EDUCATION		
Complete Postal Address: 12 CLIFFORD STREET, CLIFFORD COURT, QUIGNEY, EAST LONDON, 5201		
Telephone No: N/A	**Fax No:** N/A	**Cell No:** 083 498 7249
E-mail address: hlunguluf@yahoo.com/ 201213965@ufh.ac.za		
SECTION 2: TITLE OF STUDY		
Title of Research Project:		
Home activities grandmothers' engage their Grade 2 grandchildren to promote mathematical skills.		
Sponsor's Protocol No (If applicable) N/A		
Sponsor's Details (If applicable) N/A		
SECTION 3: STUDY FOR DEGREE PURPOSES	**Not applicable**	
Name of Degree: Master of Education	**Supervisor:** Professor N.S Duku	
Division/Department: EDUCATION	**E-mail:** NDuku@ufh.ac.za	

Contact No: 0722600656	

SECTION 4: DETAILS OF SUB-INVESTIGATORS		
Name and Title	Position	Division/Department
1.		
2.		
3.		
4.		
5.		
SECTION 5: DETAILS OF COLLABORATING INVESTIGATORS		
Name and Title	Position	Division/Department
1.		
2.		
3.		
4.		
5.		

SECTION 6: WHERE WILL THE STUDY BE CONDUCTED?	
1. East London	
2.	
3.	
4.	
5.	

SECTION 7: STUDY TYPE			
1. Industry Sponsored		2. Self Initiated	
3. Retrospective Record Review		4. Laboratory-Based Research	
5. Qualitative Research	X	6. Prospective Descriptive Study	
7. Other		8. Please state type if 'Other':	

SECTION 8: HOW IS THIS RESEARCH FUNDED? STATE APROXIMATE TOTAL BUDGET			
1. Industry	R	2. NIH	R
3. Internal/Self	R 27000	4. Other/ US Fed Agency	R

5. External SA Grant	R	6. Internat. Grant	R

SECTION 9: SIGNING OF APPLICATION

Applicant: 

Supervisor: 

***Departmental Head:**

*** Or the Dean of the Faculty or the Chairperson of the Faculty Research Ethics Committee**

The following obligatory documentation must be attached to this application form:

PROTOCOL SUMMARY / SYNOPSIS (Obligatory)

Please provide a protocol synopsis or summary of the proposed research, **in addition to the full Protocol**, that is between **800 and 1 000 words** long. The Protocol Synopsis or summary should contain the following:

- Title
- A short introduction, motivation and literature overview (1 paragraph only)
- Research question or hypothesis
- Aims and Objectives
- A concise summary of the methodology
- Description of subject population including characteristics, age range and number of subjects
- Anticipated risks as well as the precautions taken to minimize risk
- Anticipated benefits
- Ethical Considerations
- Intellectual Propert Rights Considerations (IP)

Checklist (Obligatory):	X
Investigator Declaration for principal, co- and sub investigators (Obligatory)	X
Investigator CVs	X
Protocol	X
Supervisor's declaration, where applicable	X

Questionnaire / list of questions	X

Recommendation from the Faculty Research Ethics Committee

.....
.....
.....
.....
.....

Chairperson:..... Date:.....

Recommendation from the University Research Committee

.....
.....
.....
.....
.....

Chairperson:..... Date:.....

OFFICE USE ONLY

Approved by UREC				Project ID
Conditional				
Provisional				
Final				

Appendix F: Checklist

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UNIVERSITY RESEARCH ETHICS COMMITTEE

The completed form must be submitted with the application. An incomplete checklist form will result in the return of the whole application to the originator

CHECKLIST-GENERAL
Section A. To be completed by Applicant and checked by GMRDC Office

PROTOCOL TITLE:

PROTOCOL NUMBER		PROTOCOL VERSION		PROTOCOL DATE	

	CV (max 2 pages)	Investigator Declaration	Conflict of Interest statement signed.	Admin Office Comments
PRINCIPAL INVESTIGATOR:	X	X	X	X
SUPERVISOR:				
CO-INVESTIGATORS	N/A			
1.				
2.				
3.				
4.				
5.				
6.				
OTHER STAFF				

	Applicant	Comments	Admin Office
	Y /N / NA		
Applicant Signature	Y		
Supervisor Signature	Y		
HOD Signature	Y		
Protocol synopsis	Y		
Full protocol	Y		
Page numbers on protocol?	Y		
Budget	Y		
Informed Consent Form	Y		

Questionnaires			
Other measuring tools/instruments	Y		
Recruitment material/ Advertisement(s)	N/A		
DoH or other letters of approval to conduct research	Y		
Material Transfer Agreement	N/A		

Section B: *To be completed by Applicant. The Reviewer will cross check*

INFORMED CONSENT FOR RESEARCH CHECKLIST

	Yes / No or NA (PI)	Yes/No/ NA (Reviewer)
1. That consent is being sought from the participant to participate in research.	YES	
2. The purpose of the research and where it will be conducted.	YES	
3. The expected duration of the participant's involvement in the research.	YES	
4. The total number of participants that will be involved at this site and/or South Africa and worldwide.	YES	
5. A description of all the processes and procedures to which the participant will be subjected,	YES	
6. The principal investigator's name and contact details.	YES	
7. Explanation of participants responsibilities.	YES	
8. Explanation of any randomization process if applicable).	YES	
9. Circumstances that may result in the project being terminated or the participant being withdrawn.	YES	
10. A description of foreseeable risks and discomforts.	YES	
11. A description of benefits to the participant or others both during and after the research. If there are no expected benefits, the participant must specifically be made aware of this.	YES	
12. Disclosure of alternative procedures and course of treatments available if applicable	YES	
13. Description of extent to which confidentiality will be maintained and protected.	YES	
14. Statement that sponsors of the study, study monitors or auditors or UREC members may need to inspect research records.	YES	
15. Statement that the UREC has approved the research.	YES	
16. Contact details of the committee.	YES	
17. Explanation of how research related injury will be managed and details of insurance if applicable.	NA	
18. Explanation as to whom to contact in the event of research related injury.	NA	
19. Participation in the study is entirely voluntary	YES	
20. Participants are free to withdraw at any point without explanation or any negative consequences. Their routine health care will not be adversely affected.	YES	

21. Participants must be informed of their rights to be told any new relevant information that arises during the course of the trial and the ICF should be revised, where appropriate to incorporate this information.	YES	
22. That the study will be conducted according to the International Declaration of Helsinki and other applicable international ethical codes for research on human subject.	YES	
23. Any expense to which the participant may be liable.	NA	
24. Explanation regarding payment for participation or out of pocket expenses	NA	
25. Identity of the funder , where applicable and any potential conflict of interests.	NA	
26. Where appropriate, the participant should also be requested/advised to inform his general practitioner and life insurance company or medical aid of his/her participation. □ Not considered appropriate/necessary	NA	
27. Simple, clear language has been used (Maximum Grade 8 reading level) and all medical and technical terms have been explained.	YES	

Section C. To be completed by Applicant

	Yes(PI), NA	Yes/No/NA (Reviewer)
1. Does the study have relevance and scientific or clinical value and applicability to the proposed research population?	YES	
2. Does the protocol include an adequate literature review?	YES	
3. Is the selection of subjects equitable and appropriate; adequate consideration and protection of vulnerable research populations.	YES	
4. Is the design and methodology appropriate to answer the research question?	YES	
5. Is the methodology clearly described, in sufficient detail?	YES	
6. Is the statistical analysis plan, including sample size calculations, clearly outlined and justified?	NA	
7. Are the inclusion and exclusion criteria clearly defined and appropriate?	YES	
8. Have risks been minimized and is there an acceptable balance between potential risks and benefits?	YES	
9. Does the PI have the necessary qualifications, expertise, facilities, and time and support staff, to carry out the proposed research?	YES	
10. Has a section on 'Ethical Considerations' been included in the protocol?	YES	
11. Has the informed consent process been clearly explained in the protocol?	YES	
12. Are issues relating to protection of privacy and confidentiality of data adequately addressed, especially if the study involves a retrospective review of clinical records?	YES	
13. Has a waiver of informed consent been requested if the study involves a retrospective review of clinical records?	NA	
14. Does the study involve collection of DNA/RNA and, if so, has consent been adequately sought for this?	NA	

Appendix G: Consent Forms

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Ethics Research Confidentiality and Informed Consent Form

University of Fort Hare (**School of General & Continuing Education**) is asking people from your community / sample / group to answer some questions, which I hope will benefit your community and possibly other communities in the future.

The University of Fort Hare, Faculty of Education Student Nolukholo Faith Hlungulu (Master of Education) is conducting research regarding Home Activities. I am interested in finding out more about **Home activities grandmothers' engage their Grade 2 grandchildren to promote mathematical skills.**

I am carrying out this research to help discover home activities that can be incorporated in the Teaching and Learning Grade 2 mathematics.
Please understand that you are not being forced to take part in this study and the choice whether to participate or not is yours alone. However, I would really appreciate it if you do share your thoughts with me. If you choose not take part in answering these questions, you will not be affected in any way. If you agree to participate, you may stop me at any time and tell me that you don't want to go on with the interview. If you do this there will also be no penalties and you will NOT be prejudiced in ANY way. Confidentiality will be observed professionally.

I will not be recording your name anywhere on the questionnaire and no one will be able to link you to the answers you give. Only the researchers will have access to the unlinked information. The information will remain confidential and there will be no "come-backs" from the answers you give.

The interview will last around 45 minutes. I will be asking you a questions and ask that you are as open and honest as possible in answering these questions. Some questions may be of a personal and/or sensitive nature. I will be asking some questions that you may not have thought about before, and which also involve thinking about the past or the future. I know that you cannot be absolutely certain about the answers to these questions but I ask that you try to think about these questions. When it comes to answering questions there are no right and wrong answers. When I ask questions about the future I am not interested in what you think the best thing would be to do, but what you think should be done to assist or improve teaching practice.

If possible, I would like to come back to you once I have completed the study to inform you of what the results are and discuss findings and proposals around the research and what this means for Initial Teacher training.

INFORMED CONSENT

I hereby agree to participate in research regarding **'home activities grandmothers' engage their Grade 2 grandchildren to promote mathematical skills'**. I understand that I am participating freely and without being forced in any way to do so. I also understand that I can stop this interview at any point should I not want to continue and that this decision will not in any way affect me negatively.

I understand that this is a research project whose purpose is not necessarily to benefit me personally.

I have received the telephone number of a person to contact should I need to speak about any issues which may arise in this interview.

I understand that this consent form will not be linked to the questionnaire, and that my answers will remain confidential.

I understand that if at all possible, feedback will be given to my community on the results of the completed research.

.....

Signature of participant **Date:** .....

I hereby agree to the tape recording of my participation in the study

.....

Signature of participant **Date:** .....

Appendix H: Supervisor Consent

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UNIVERSITY RESEARCH ETHICS COMMITTEE
SUPERVISOR'S DECLARATION

The supervisor must sign a declaration for each student project supervised.

A. RESEARCHER

Surname	HLUNGULU			**Initials**	NF	**Title** MISS
Department	EDUCATION					
Telephone no.	**Cell**	083 498 7249	**email**	hlungulu f@yahoo.com/20121 3965@ufh.ac.za	**Fax**	N/A

B. SUPERVISOR

Surname	Duku			**Initials**	N.S	**Title** Prof
Capacity	Supervisor					
Department	SGCE: EDUCATION					
Present position	Deputy HOD			**E-mail**	nduku@ufh.ac.za	
Telephone no.	**(W)**	043- 704 7222	**Cell**	0722600656	**Fax**	N/A

B. PROJECT TITLE (MAXIMUM OF 250 CHARACTERS FOR DATABASE PURPOSES)

Home activities grandmothers' engage their Grade 2 grandchildren to promote mathematical skills.

I, Professor Nkanbonuko Stunky Duku declare that

- **I have read through the submitted version of the research protocol and all supporting documents and am satisfied with their contents. I am satisfied that the scientific content of the research is satisfactory and up to standard for an educational qualification at this level.**
- I am **suitably qualified and experienced** to supervise the above research study.
- **I undertake to fulfill the responsibilities of the supervisor** for this study as set out in the university policy
- I take responsibility for ensuring that the applicant is up to date and complies with the requirements of the law and relevant guidelines relating to security and confidentiality of research participants and other personal data, in conjunction with supervisors as appropriate.
- I take responsibility for ensuring that the applicant is up to date and complies with all regulatory and monitoring requirements of the UREC
- I agree to supervise the described study in accordance with the relevant, current protocol and **will only change the protocol after approval by the UREC.**

NF Hlungulu

- I agree to ensure the applicant maintains **adequate and accurate records**.
- I take responsibility for ensuring that this study is conducted in accordance with the ethical principles underlying the Declaration of Helsinki as well as South African and ICH GCP Guidelines and the Ethical Guidelines of the Department of Health as well as applicable regulations pertaining to health and other research with supervisors as appropriate.
- I agree that I am conversant with the above **guidelines**.
- I will ensure that the applicant treats every participant **in a dignified manner and with respect**.

Supervisor :: Professor N. S Duku

Signature :  **Date: 29/07/2016**

CONFLICT OF INTEREST DECLARATION (OBLIGATORY)

The researcher is expected to declare to the University Research Ethics Committee (UREC) the presence of any potential or existing conflict of interest that may potentially pose a threat to the scientific integrity and ethical conduct of any research in the University.

The UREC will decide whether such conflicts are sufficient as to warrant consideration of their impact on the ethical conduct of the study.

Disclosure of conflict of interest does not imply that a study will be deemed unethical, as the mere existence of a conflict of interest does not mean that a study cannot be conducted ethically. However, failure to declare to the UREC a conflict of interest known to the researcher at the outset of the study
will be deemed to be unethical conduct.

Researchers are therefore expected to sign *either* of the two declarations below:

a) As the Principal Researcher in this study (name: HLUNGULU NOLUKHOLO FAITH)

I hereby declare that I am **not aware** of any potential conflict of interest which
may influence my ethical conduct of this study.

Signature:  Date: 29/07/2016

b) As the Principal Researcher in this study (HLUNGULU NOLUKHOLO FAITH)

I hereby declare that I am **aware** of potential conflicts of interest which
should be considered by the UREC:

Signature: _____ Date:

Appendix I: Conflict of Interest

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RESEARCH ETHICS COMMITTEE

RESEARCHER'S DECLARATION AND CONFLICT OF INTEREST DECLARATION
(To be completed in typescript)
The principal investigator, as well as all sub- & co-investigators must each sign a separate declaration.

A. RESEARCHER

Surname	HLUNGULU			**Initials**	NF	**Title**	MISS
Capacity	**Principal Investigator**	X	**Sub-Investigator**		**Co-Investigator**		
Department	Residence						
Present position	ACCOMMODATION OFFICER			**E-mail**	hlungulufi@yahoo.com/ 201213985@ufh.ac.za		
Telephone no.	**(W)**	043 704 7332	**Cell**	083 498 7249		**Fax**	N/A

B. PROJECT TITLE (MAXIMUM OF 250 CHARACTERS FOR DATABASE PURPOSES)

Home activities grandmothers' engage their Grade 2 grandchildren to promote mathematics.

I, (Miss Hlungulu Nolukholo Faith), declare that

- **I have read through the submitted version of the research protocol and all supporting documents and am satisfied with their contents**
- I am **suitably qualified and experienced** to perform the above research study.
- I agree to conduct or supervise the described study **personally** in accordance with the relevant, current protocol and will only change the protocol after approval by the **UREC**, except when urgently necessary to protect the safety, rights, or welfare of subjects. In such a case, I am aware that I should notify the UREC without delay.
- I agree to timeously report to the UREC **serious adverse events** that may occur in the course of the investigation.
- I agree to maintain **adequate and accurate records** and to make those records available for inspection by the appropriate authorised agents when and if necessary.
- I agree to comply with all other requirements regarding the obligations of clinical investigators and all other pertinent requirements in the Declaration of Helsinki, as well as South African and ICH GCP Guidelines and the Ethical Guidelines of the Department of Health as well as applicable regulations pertaining to health and other research.
- I agree to comply with all regulatory and monitoring requirements of the UREC.
- I agree that I am conversant with the above **guidelines**.
- I will ensure that every research subject or other involved persons, such as relatives, shall at all times be **treated in a dignified manner and with respect**.
- I will submit all required reports within the stipulated **time frames**.

Principal : **Nolukholo F. Hlungulu**

Signature : **Date: 29/07/2016**

NF Hlungulu

CONFLICT OF INTEREST DECLARATION (OBLIGATORY)

The researcher is expected to declare to the University Research Ethics Committee (UREC) the presence of any potential or existing conflict of interest that may potentially pose a threat to the scientific integrity and ethical conduct of any research in the University.

The UREC will decide whether such conflicts are sufficient as to warrant consideration of their impact on the ethical conduct of the study.

Disclosure of conflict of interest does not imply that a study will be deemed unethical, as the mere existence of a conflict of interest does not mean that a study cannot be conducted ethically. However, failure to declare to the UREC a conflict of interest known to the researcher at the outset of the study
will be deemed to be unethical conduct.

Researchers are therefore expected to sign *either* of the two declarations below:

c) As the Principal Researcher in this study (name: HLUNGULU NF)

I hereby declare that I am **not aware** of any potential conflict of interest which may influence my ethical conduct of this study.

Signature:  Date: 29/07/2016

d) As the Principal Researcher in this study (name: HLUNGULU NF)

I hereby declare that I am **aware** of potential conflicts of interest which should be considered by the UREC:

Signature: _____ Date: _____

Appendix J: Editor's Certificate

EDITING/PROOFREADING CERTIFICATE

To whom it may concern

This serves to certify that I, Jabulani Mkhize, have proofread and/or edited Ms. F. Hlungulu's Master's dissertation to ensure that the language, grammar, punctuation and spelling are academically sound and appropriate, by rectifying errors, wherever these have been identified, and rephrasing sentences that would possibly make one lose sight of the flow of the argument.

Dissertation Title: "Home activities grandmothers engage their grandchildren to promote Grade 2 mathematical skills"

Editor's Name: Jabulani Mkhize

Signature : 

Date : 18 June 2017

Contact Details: jmkhize@ufh.ac.za

Qualifications: PhD (English)