THE TEACHERS' PERCEPTIONS IN MAKING CONNECTIONS BETWEEN MATHEMATICS AND EVERYDAY LIFE EXPERIENCES

BY

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DECLARATION

I, **Patricia Mmakwena Makgopela**, declare that this dissertation is my own work in design and execution. It is submitted for the Degree of Master of Education (Mathematics/Science Education) in the North West University, (Mafikeng Campus), South Africa. This project has never been submitted before for any degree or examination in this or any other university. All sources contained herein have been duly acknowledged.

I will not allow anyone to copy my work with the intention of presenting it as his or her own.

Signed this .... **Day of** **2010**

....

PATRICIA MAKGOPELA

DEDICATION

This research project is dedicated to everyone who has the interest of mathematics at heart. I also dedicate this project to my parents, David and Martha Malebane, who laid a foundation of education in my life, my in-laws, my beloved husband, (Lolo) and daughters [Gosego, Boipelo and Keoratile (my adopted daughter)], who supported me and persevered while I was furthering my studies. May God Almighty Bless them.

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ABSTRACT

A research was conducted to explore the teachers' perceptions in making connections between mathematics and everyday life activities. This study explained how educators demonstrated connections between mathematics and everyday life experiences.

The focus was what educators' views were on mathematics and life in general as well as how the two are connected. The study provides a starting point for teachers in structuring the curriculum, instruction and assessment to help learners make the connections of mathematics to real life experiences, including applications of mathematics in the workplace. The study sought to answer the following questions:

- What do we mean when we talk about connections between mathematics and everyday life?
- How do teachers connect mathematics to everyday life?
- What challenges do teachers face when they apply Mathematics to their everyday lives?
- What may be done to help educators to be able to make connections between mathematics and everyday life?

Data was collected from mathematics educators in schools around the Mafikeng area. Collection of data included Observations, interviews and questionnaires. Both quantitative and qualitative analysis of data were implemented. The data suggested that the teachers' mathematical knowledge influenced how they planned their instructions, implemented the textbook, interacted with learners and demonstrated the connection of mathematics to everyday life experiences.

The study indicated that more workshops and in-service training were needed to empower educators on the integration of the connections of mathematics knowledge and skills to everyday life in their lessons. Educators need to further their studies in order to improve their qualifications thus acquiring more knowledge on how to demonstrate to their learners the connection of mathematics to everyday life experiences.

The findings of this study imply that the connection of mathematics to everyday life experiences was done on a daily basis but some educators were not aware of that. It is the teachers' task to make learners aware that mathematics is applied everyday in the daily activities at home, schools and work places.

The recommendations that might improve the teachers' perceptions in making connections between mathematics and everyday life experiences were professional development of educators, in - service training and workshops. The researcher believes that a professionally developed educator will automatically be enthusiastic, develop a love for mathematics and have the interest of the learners at heart.

TSHOBOKANYO

Patlisiso e dirilwe go utulola bokgoni le maikutlo a barutabana mo go direng kgolagano magareng ga maranyane a dipalo (mathematikisi) le ditiragalo tsa botshelo tsa letsatsi le letsatsi. Ithuto e tlhalosa bonontlhotlho jwa barutabana mo tshupetsong ya kgolagano magareng ga mathematikisi le maitemogelo mo botshelong jwa segompieno.

Maikaelelo a ithuto eno ke go batlisisa bokgoni le maikutlo a barutabana mo go direng kgolagano magareng ga mathematikisi le botshelo jwa letsatsi le letsatsi le kgopolo ya barutabana mabapi le mathematikisi le botshelo ka kakaretso. Ke maikaelelo a ithuto eno go neela barutabana dintlha tseo ba ka di latelang go bopa thulaganyo ya marutwa, taelo le tekanyetso go thusa baithuti go dira kgolagano magareng ga mathematikisi le botshelo jwa segompieno, mmogo le tiriso ya maranyane a dipalo kwa tirong.

Ithuto e rulagantse go araba dipotso tse di latelang:

- Re kaya eng fa re bua ka kgolagano magareng ga mathematikisi le botshelo jwa letsatsi le letsatsi?
- Barutabana ba golaganya jang mathematikisi le botshelo jwa letsatsi le letsatsi?
- Ke dikgwetlo dife tseo barutabana ba lebaganeng le tsona go fa ba tsenya tirisong mathematikisi mo botshelong jwa letsatsi le letsatsi?
- Ke eng seo se tla dirwang go thusa barutabana le go ba kgontsha go dira kgolagano magareng ga mathematikisi le botshelo jwa letsatsi le letsatsi?

Dinewa di kgobokantswe go tswa go barutabana ba mathematikisi bao ba rutang mo dikolong tsa sedika sa Mafikeng. Go dirisitswe tebatibiso e e tseneletseng, pitso therisano le lenaneo la dipotso go kgobokanya dinewa. Boleng le bokanakang jwa tshetshereganyo ya dinewa bo ile jwa tsenngwa tirisong. Dinewa di tshitshintse gore kitso ya barutabana ya serutwa sa mathematikisi e ne e le tlhotlheletso mo thulaganyong ya ditaelo, go tsenya tirisong bukakgakololo, go golagana le baithuti le tshupetso ya kgolagano magareng ga mathematikisi le botshelo jwa letsatsi le letsatsi.

Ithuto eno e supile fa go tlhokega ikatiso ya ditlhophana le boithutelo – tirong go natlafatsa barutabana ka tsereganyo le kgolaganyo ya kitso le bokgoni jwa serutwa sa mathematikisi modithutong tsa bone tsa letsatsi le letsatsi.

Barutabana ba tlhoka go tsweletsa dithuto tsa bona go tokafatsa borutegi se e le go amogela kitso ya mokgwa oo go ka dira tshupetso ya kgolagano magareng ga mathematikisi le botshelo jwa letsatsi le letsatsi, go baithuti. Diphitlhelelo mo ithutong eno di supa gore kgolagano magare ga mathematikisi le botshelo jwa letsatsi le letsatsi, di dirwa letsatsi le letsatsi fela batho ba le bantsi ga ba ele seo tlhoko. Ke tiro ya barutabana go tsibosa baithuti gore serutwa sa mathematikisi se nna mo tirisong letsatsi lengwe le lengwe kwa gae, kwa ditirong le kwa dikolong.

Dikatlanegiso tseo di ka tokafatsang bokgoni jwa barutabana go dira kgolagano magareng ga maranyane a dipalo (mathematikisi) le botshelo jwa letsatsi le letsatsi, ke go tsweletsa dithuto tsa bona go tokafatsa borutegi, ikatiso ya ditlhophana le boithutelo – tirong. Motlhotlhomisi o dumela gore fa barutabana ba le tokafaditse borutegi jwa bone, ka go itirisa ba nna le phisego, kgolo ya lerato mo serutweng sa mathematikisi le kgatlhego ya baithuti go tswa botennyeng jwa dipelo tsa bone.

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LIST OF ACCRONYMS AND ABBREVIATIONS

AMESA : Association of Mathematics Education in South Africa

APO : Area Project Office

AS : Assessment Standards

C2005 : Curriculum 2005

CASS : Continuous Assessment

CM : Cultural Mathematics

CTA : Common Task for Assessment

DoE : Department of Education

FME : Formal Mathematics Education

H.O.D. : Head of Department

IFME : Informal Mathematics Education

IMP : Indigenous Mathematics Project

INSET : In-service Education and Training

LO : Learning Outcomes

MASA : Mathematics Association of South Africa

NAGB : National Assessment Governing Board

NCS : National Curriculum Statement

NFME : Non-Formal Mathematics Education

OBE : Outcomes – Based Education

RNCS : Revised National Curriculum Statement

SAMF : South African Mathematics Foundation

SPSS : Statistical Package for the Social Sciences

CHAPTER 1

ORIENTATION

1.1 INTRODUCTION AND BACKGROUND

"Mathematical power is a function of students' prior knowledge and experience and the ability to connect that knowledge in productive ways to new contexts" (National Assessment Governing Board [NAGB], 1996:4). Mathematically literate person must not only have an understanding of mathematical content, but also be able to make connections among mathematical topics and to apply mathematical knowledge and understanding to other disciplines and a variety of life situations.

According to Caine and Caine (1990:66-69, online), students come to school with a variety of experiences and personal constructs about mathematics. When students learn a new concept they naturally make connections to what they already know and develop their own understandings in ways that make sense to them. Caine and Caine (1990) further state that learners may make accurate connections to previous knowledge, or they may develop or reinforce misconceptions that are very difficult to change. It is the role of the teacher to help learners build accurate constructs about mathematical ideas and be able to apply their knowledge to both predictable and unpredictable situations.

According to Adler, Lelliot, Rapoo, Brodie, Reed and Setati (1997), connections within mathematics become successful only if learners and educators acquire the mathematical knowledge and skills that are to be linked to the new work or everyday life. The South African Mathematics Foundation (SAMF, 2008), points out that we should educate a citizen who loves the land enough to farm it and make a living from it.

This study explained how competent, educators are in demonstrating connections between mathematics and everyday life. This study on connections intended to provide a starting point for teachers in structuring the curriculum, instruction, and assessment to help learners make the connections to real life experiences, including mathematical applications in the workplace. NAGB (1996) further states that defining mathematics in terms of arithmetic, algebra, geometry, or any mathematical content area, is like trying to define an elephant by describing a few of its parts.

To define mathematics in this way ignores the rich connections between the content areas and, more importantly, the fundamental act of doing mathematics. SAMF (2008) states that both educators and learners should appreciate mathematics as an essential element of communication. They should develop awareness of the fascination of mathematics, imagination, initiation and flexibility of mind.

Caine and Caine (1990:66-69, online), emphasise that mathematics is the language and science of patterns which involves conjecturing, testing, modelling, identifying patterns, verifying, analysing, and making generalizations. These processes can be developed more fully if they are experienced throughout the various content strands of mathematics.

The interrelationships between and among concepts need to be brought to learners' conscious levels in ways that help them see the connected nature of mathematics and its usefulness in other disciplines and real-life experiences. "Mathematics develops problem-solving ability, logical thinking and equips students with analytical skills that are important to individuals, society and academic world" (Mwakapenda, 2002:267). Learners should acquire the personal qualities of working in a systematic way, independently and cooperatively. They should consider an in-depth study of mathematics and have confidence in their mathematical abilities.

Killen (1996) continues to argue that seeing the relationships among procedures and concepts also helps deepen learners' mathematical understanding. In addition, making connections between the mathematics they study and its applications in their everyday lives, helps learners see the usefulness and relevance of mathematics beyond the classroom. Experiences that allow learners to make connections – to see, for example, how concepts and skills from one strand of mathematics are related to those from another will help them to grasp general mathematical principles. Killen (1996) explains that as they continue to make such connections, learners begin to see that mathematics is more than a series of isolated skills and concepts, and that they can use their learning in one area of mathematics to understand another area and also to apply it in real life situations.

SAMF (2008) states that it is the role of the teacher to help learners build accurate constructs about mathematical ideas and be able to apply their knowledge to both predictable and unpredictable situations. When teachers take account of the learners' prior knowledge and are familiar with learners' cultural backgrounds, learning style preferences, and experiences in and out of school, they increase the opportunities to foster important connections and facilitate learner understanding of mathematics. "Mathematics is about posing and solving problems and also finding the appropriate linkages between concepts" (SAMF, 2008:20). Von Glaserfeld (1995) argues that, most commonly, knowledge is perceived to be constructed personally and is an individual possession. Mathematics is seen as a subject for "advancement" in a technological society. The researcher examined the teachers' perceptions in making connections between mathematics and everyday life experiences.

1.2 STATEMENT OF THE PROBLEM

The problem to be investigated was the teachers' perceptions in making connections between mathematics and everyday life experiences. According to the SAMF (2008:1), mathematics is often done in conjunction with other fields and it is wise to have a strong background in mathematics for most areas in the engineering, health and social sciences. Through the study, the researcher was able to write a report informing the Department of Education (DoE) and society about the teachers' perceptions in making connections between mathematics and everyday life experiences.

Making connections is an important human activity. In their study of "workings of the brain", Caine and Caine (1990) stated that seeking patterns and connections is the natural activity of the brain. Isolated pieces of information require more time to assimilate than learning experiences that are connected with a person's prior knowledge.

According to the DoE (2005), an integrated understanding of mathematical concepts is provided for in the Learning Outcomes (LO's) as well as the requirement that teachers guide learners on how to use existing knowledge and understanding to solve problems.

This is evidence of the developments brought about by the National Curriculum Statement (NCS). For example the application of mathematics learned can be used in real life situations whereby mathematical models such as 3-dimensional shapes are designed. "Mathematics is one of the most fascinating of all intellectual disciplines; it is an art form and a challenging game. The study of mathematics is not only exciting, but important. Analytical thinking skills are in high demand by employers and studying mathematics develops the ability to work in a problem-solving environment" (SAMF, 2008:1).

1.3 RESEARCH QUESTIONS

Research investigations were based on the following questions:

- What do we mean when we talk about connections between mathematics and everyday life?
- How do teachers connect mathematics to everyday life?
- What challenges do teachers face when they apply mathematics knowledge to everyday lives?
- What can be done to help educators to be able to make connections between mathematics and everyday life?

The researcher used observations, interviews and questionnaires to collect, interpret and analyze data in order to answer these research questions.

1.4 AIMS OF THE STUDY

Without an aim, this research could have not been pursued. The researcher had specific aims to conduct the study. The aims were:

- To determine empirically the educators' views on challenges they face when they connect mathematics to everyday life experiences;
- To examine the meaning of "connections between mathematics and everyday life experiences";
- To investigate how teachers connect mathematics to everyday life experiences;
- To suggest ways in which teachers can be helped in making connections between mathematics and everyday life experiences;

- To determine from the literature other researchers' comments on teachers' perceptions in making connections between mathematics and everyday life experiences;
- To determine from the literature the impact that teachers have on learners and community members in making connections between mathematics and life in general.

Based on the points mentioned above, the researcher's question was always "what am I trying to find out?" The researcher ensured that these points were given special consideration throughout the study. The success of the study depended on these points so it was important for the researcher to always keep on referring back to the purpose of the study.

1.5 SIGNIFICANCE OF THE STUDY

The significance of the study was to inform society about the teachers' perceptions in making connections between mathematics and everyday life experiences. The researcher also informed society about the importance of mathematics to life in general. The study hopefully established whether mathematics teachers were able to serve as role models in showing learners and the community the importance of mathematics through its connections and applications to daily life. It was anticipated that the findings really enhanced the understanding of the role that teachers played in and out of classrooms. How do educators connect mathematical knowledge to everyday life? It was the purpose of this study to investigate the teachers' perceptions in making connections between mathematics and everyday life experiences. It was also the intention of this study to find out what teachers' views were about mathematics and daily life situations.

This study is important because currently there is much emphasis on the need for mathematics in different careers. SAMF (2008) explains that the public and the politicians in particular, want the education process to take a leading role in imparting mathematics knowledge and skills. This study looked at educating the community that mathematical knowledge could be used in our everyday life. It also looked at what was actually happening at the classroom level as far as mathematics was concerned.

The researcher's question was "why is this study worth doing"? Throughout this study, the researcher was able to compile a report about the teachers' perceptions in making connections between mathematics and everyday life experiences. A report was also compiled about the challenges that teachers faced in the practical application of their mathematics knowledge to other learning areas and to life in general. The compiled report might help the Department of Education to make amendments to mathematics curricula.

1.5.1 Anticipated outcomes

What will happen as a result of this study? The study might have important implications for the training of mathematics teachers in the country, educational policies and the mathematics curriculum. The study might have implications for the teachers' perceptions in making connections between mathematics and everyday life experiences. The study intended to increase knowledge about:

- Mathematics teaching, learning and understanding, and
- Mathematics connections to everyday life experiences.

1.5.2 Relevance to Education

How is the research relevant to the field of education? This research covered the following areas of educational research and hopefully led to an increase in knowledge in these areas of mathematics education:

- Policy and practice - the educational policies and their relation to practice.
- Classroom practice - Observations of teacher practices. How do teachers demonstrate the connections of mathematics to everyday life?
- Structured interviews - What are the teachers' views concerning making connections between mathematics and everyday life experiences?

1.6 DELIMITATIONS AND LIMITATIONS

Delimitations and limitations of the study are outlined on the next page.

1.6.1 Delimitations

The study was delimited to primary and secondary schools around Mafikeng area.

1.6.2 Limitations

The limitations of the study are listed and discussed in the following sections:

1.6.2.1 The Consent Form

Some educators did not sign the consent form because they did not want their names and signatures to appear in the study. However, the researcher advised them to put an 'X' or a '√' (tick) in the name and signature space.

1.6.2.2 Questionnaires

There are limitations of having Likert scales only. Questionnaires were initially distributed to 10 schools but due to the poor response of some educators, the researcher had to distribute to other schools. The number of schools went up to 15. Out of 15, only 12 schools responded positively. Other educators felt that some questions were asking for personal information and they did not want to complete those parts, however, the researcher assured them that their names would not be used in the study and that they should do their part as requested and directed by the researcher.

1.6.2.3 Observations and Interviews

Selection of teachers to be observed and interviewed was done with specific reference to the location of schools, gender and financial considerations. Only one mathematics teacher per school was observed and interviewed. The researcher wanted to use audio-visual equipment (videos) to get more details during the classroom observations, but considered the novelty of the equipment as more of a distraction to "normal" classroom processes. Initially the researcher intended to observe and interview one educator per school (12 educators), but due to the unavailability of educators, only six educators were observed and interviewed.

Terms used in the study are defined on the next page.

1.7 DEFINITION OF TERMS

The following terms were used in the study and were defined as indicated below:

Assessment

(i) A continuous planned process of gathering information on learner performance, measured against the assessment standards (Department of Education, 2002 :101).

(ii) Van der Horst and McDonald (2003) define assessment as a strategy for measuring knowledge, behaviour or performance, values or attitudes. It is a data gathering strategy and the measurement of data that an educator gains from assessment helps the educator to evaluate what has been taught. They emphasise that it must be comprehensive and holistic.

Attitude

A mental and neural state of readiness organised through experience, exerting a directive or dynamic influence upon the individual's response to all objects and situations with which it is related (Schoenfeld, 1992). It is a way of thinking or behaving.

Constructivism

Constructivism is a theory of learning that grew primarily out of the pioneering work of Jean Piaget (1896-1980), a Swiss psychologist and Lev Vygotsky (1896-1934), a Russian psychologist (Troutman and Lichtenberg, 2003:14).

Troutman and Lichtenberg (2003) explain constructivism as a way of thinking about knowing, a referent for building models of teaching, learning and curriculum, and therefore in this sense it is a philosophy of building on knowledge known by the learner.

Simple ideas in constructivism are called trivial or personal constructivism and can be summed up by the following quote from Jean Piaget, "Knowledge is actively constructed by the learner, not passively received from the environment" (Troutman and Lichtenberg, 2003:14).

Continuous assessment

The assessment model that encourages integration of assessment into the teaching and the development of learners through ongoing feedback (Department of Education, 2002).

Curriculum 2005

(i) Curriculum 2005 is the first version of the post-apartheid National Curriculum Statement (Department of Education, 2002).

(ii) Blake and Hanley (1995) explain curriculum as a course of study which involves planned and unplanned learning in learning institutions.

Mafikeng area

Mafikeng area is the geographical area around Mmabatho, the capital city of the North West province of South Africa (Kwayisi, 2006).

Mathematics

"Mathematics is a human activity that involves observing, representing and investigating patterns and quantitative relationships in physical and social phenomena and between mathematical objects themselves" (Van der Horst and McDonald, 2003: 53).

Mathematics is a human activity which involves a study of numbers, measurements and shapes using reasons, special system of symbols and rules for organising them (Nelson, 2003).

Mathematical concept

A mathematical idea of categories of items that need to be taught and learned (Department of Education, 2002).

Outcomes-Based Education

A process and achievement oriented, activity-based and learner-centred education process; in following this approach, C2005 and the Revised National Curriculum Statement (RNCS), schools aim to encourage lifelong learning (Department of Education, 2002).

School mathematics

The researcher defined school mathematics as mathematics which is taught and assessed at school.

Perceptions

An act of becoming aware of something or to be concerned about something (Bloomsbury, 1999).

Teachers or Educators

Individuals who are employed by the Department of Education in a school setting with full qualifications as desired by the Department (Department of Education, 2005).
[The terms teachers and educators will be used synonymously].

An outline of chapters is discussed below.

1.8 OUTLINE OF CHAPTERS

The study is organised as follows:

Chapter 1: Orientation

This chapter gives a brief historical background of the problem. It provides an overview of the study. It gives an introductory part of the study whereby the history of mathematics is clearly outlined. It explains the statement of the problem, the significance of the study, research questions, aims, limitations and delimitations of the study. Terms that are used in the study are defined. Chapter headings which explain the plan of the study form the last part of this chapter.

Chapter 2: Literature Review

Literature review based on the teaching and integration of mathematics with specific reference to the South African Education Policy, is discussed. The teaching and learning theories and the teaching strategies that are practiced in mathematics lessons are outlined. The researcher's objective is to review literature related to the theme of the study and to investigate other researchers' views on the connection of mathematics to everyday life. Different sources are used. Influential factors and the stereotypes that affect the connection of mathematics to everyday life are also discussed.

Chapter 3: Research Methodology

This chapter gives an outline of the research strategy and how the study was carried out. The focus is on the research methods, instruments, population and sampling. Special consideration is given to the ethical status of the study.

Chapter 4: Data analysis and Interpretation

This chapter gives an explanation of how data was interpreted and analysed. A description of methods of analysing data, observation and interview sessions, findings and review of respondents are also outlined.

Chapter 5: Summary, Recommendations and Conclusion This chapter summarises everything concerning the study. Findings based on the information collected from respondents are discussed. A clear presentation of recommendations and conclusions is given.

1.9 SYNTHESIS

The introductory chapter was a brief orientation of the study with focus on the problem that was investigated

The review of related literature will be dealt with in the next chapter.

CHAPTER 2

REVIEW OF RELATED LITERATURE

2.1 INTRODUCTION

The researcher used secondary sources such as books, newspaper articles, dictionaries, journals and websites as a source of literature. These sources were used for more information concerning the teachers' perceptions in making connections between mathematics and everyday life experiences. Silverman (2003:226) points out that the review of related literature should be used to display scholarly skills and credentials, and it involves a systematic identification, location and analysis of documents containing information related to the research problem.

According to Setati (2002) cited by Diale (2005:11), "mathematics has a widespread public image as being difficult, abstract, theoretical, ultra-rational but important. It has an image of being remote and inaccessible to all but a few super-intelligent human beings with mathematical minds". Varieties of mathematics experience and the mathematical community were considered with special reference to the teachers' perceptions in making connections between mathematics and everyday life experiences.

2.1.1 Identification of literature

The following guideline was taken into consideration when identifying relevant literature and sources of data:

- The use of a library catalogue, index and abstracts, online databases.
- Looking at government publications.
- Surfing the world-wide web.
- The use of the citations and reference lists of other researchers.

2.2 THEORIES UNDERPINNING THE RESEARCH

The researcher investigated what other researchers and authors said about the teachers' perceptions in making connections between mathematics and everyday life. The paradigm under which the research was conducted was post-modernism.

Diale (2005) asserted that post-modernism is an underlying philosophy about the world and that constructivism is a general theory of cognition, suggesting how the mind works and how we know things.

Doll (1989:244) emphasises that the facets of a post-modernist curriculum are:

- the nature of open as opposed to closed-systems
- the structure of complexity as opposed to simplicity and
- transformative as opposed to accumulative change.

Based on Doll's points and the researcher's experience, it is a fact that the South African curriculum prior to 1994 was teacher-centred and mathematics was not a compulsory subject as it now is, thus making it difficult for the educators of that time, to demonstrate the connections of mathematics to everyday life experiences.

2.2.1 Philosophical background

In post-modernism, the emphasis is on contextual construction of meaning and the validity of multi-perspectives, hence a variety of connections of mathematics to everyday life experiences should reflect how educators teach, how learners learn and how problem solving is applied in mathematics.

According to Diale (2005), the mathematics curriculum has outcomes, which are driven by these principles of post-modernism. According to Doll (1989), closed systems were used in education prior to 1994 in South Africa. Doll (1989), as cited in Seeletse (2005: 5), points out that the modernist curriculum adopted a closed vision where through focussing on what the mathematics teachers taught, knowledge was transmitted and transferred to learners. Seeletse (2005) continues to cite Doll (1989) by stating that transmission framed the teaching process under which the modernist curriculum and good teaching resulting in good learning, were defined as the transfer of knowledge.

2.2.2 Theoretical Background

The theoretical background of the study is discussed on the following page.

2.2.2.1 South African Education Policy

Van der Horst and McDonald (2003) state that between 1990 and 1994, the African National Congress party, as a government - in - waiting came up with a research programme for policy development from which the National Education Policy Investigation was produced in 1992. The first post-apartheid (democratic) revisions of syllabus occurred in 1994. These revisions did away with racism and concentrated on formulating aims of the innovated curriculum (Department of Education, 2002). It was announced in 1997 that "the first break with apartheid", Outcomes – Based Education (OBE), would be introduced as part of C2005. In 1998, OBE was implemented in South African schools for the South African education system (Chisholm, 2004).

- **Outcomes – Based Education (OBE)**

The originator of outcomes-based education (OBE), Bill Spady (1988), defines OBE as focusing and organising all of the school's programmes and instructional efforts around the clearly defined outcomes we want all the learners to demonstrate when they leave school. Van der Horst and McDonald (2003) explain that OBE is aimed at stimulating the minds of learners so that they are able to develop and achieve to their maximum ability, participate fully in economic and social life and are equipped for lifelong learning. According to Spady (1988), OBE is not a programme but a way of designing, delivering and documenting instruction in terms of its intended goals and outcomes.
Spady and Marshall (1991) argue that OBE was rooted in the four learning approaches which are; the educational objectives movement, competency-based education, mastery learning and criterion-referenced instruction and assessment. The DoE (2002) explains that the learning outcomes (LOs) and Assessment Standards (ASs) were designed from the critical and the developmental outcomes.

DoE (2002) informs us that Spady, an American educationalist, became highly influential in curriculum planning and development in South Africa after 1994. His appeal lay in the schemata he produced to distinguish, amongst other things, traditional, transitional and transformational OBE. Traditional OBE encompassed negative elements of education such as rote learning, subject division, content-based knowledge and summative assessment.

Transformational OBE emphasised the opposite; learning shaped by outcomes, integrated knowledge and formative assessment. Spady and Marshall (1991) state that advocates of OBE agree that an outcome is a successful demonstration of learning that occurs at the culminating point of a set of learning experiences. The word 'culminating' refers to the completion point of a segment of curriculum – what learners are ultimately able to do at the end, once all formal instruction is over, and can be synthesised and applied successfully. Van der Horst and MacDonald (2003) clarify that Outcomes Based Education does not imply: Pass one, pass all. It means, Show that you understand, that you can apply a skill, that you developed a positive disposition.

❖ The Revised National Curriculum Statement (RNCS)

According to Van der Horst and McDonald (2003), RNCS is an improved version of Curriculum 2005 (C2005). It encourages sensitivity to issues of poverty, inequality, race, gender, age, disability and HIV/AIDS (Department of Education, 2002). It adopts an inclusive approach where the special educational, physical, emotional and social needs of learners will be addressed through learning programmes. C2005 was still to be implemented in high schools when the sudden review of OBE was put into action. Later the National Curriculum Statement (NCS) was introduced.

❖ National Curriculum Statement (NCS)

The NCS is the foundation of the continuous process of curriculum development, its application and a National Policy on Assessment and Qualifications for the South African schools in the General Education and Training Band (Department of Education, 2003). It is an improved version of Curriculum 2005 (C2005). According to Chisholm (2004), the NCS consists of 24 learning areas i.e. 11 official languages and 13 subjects. Subject specialists developed the subject statements which make up the NCS.

❖ The Principles underpinning the curriculum

According to the DoE (2003) the NCS has the following principles that inform all LO's and AS's:

- *Social justice:* Reminds all humanity that everyone should have equal opportunity to improve his/her living conditions. It is one's responsibility to care for others.

- *A healthy environment:* Everyone is entitled to a healthy environment. Environment involves the social, political, economical and biophysical aspects of life and life support systems.
- *Human rights:* They offer protection to everyone thus freeing us from difficult positions.
- *Inclusivity:* It discourages discrimination amongst learners. All learners should be accommodated, irrespective of their race, language, culture, ability and economic background.
- *Outcomes-based Education:* Allows learner participation and encourages active learning approaches.
- *A high knowledge and skills for all:* All learners will be offered opportunities to develop a high level of knowledge and skills.
- *Clarity and Accessibility:* The NCS should be easily used and understood by all educators and learners hence it is available in all official languages.
- *Progression and Integration:* Learners progress from one grade to the other and are promoted from one phase to the other.

Integration shows how learning areas are linked and allows the expanded opportunities for learning to be easily implemented, thus, making it easy to connect mathematics to everyday life.

2.2.3 Roles and Responsibilities of stake-holders in OBE

- **Educators**

The DoE (2003) states that educators are responsible for developing appropriate instructional strategies to help learners achieve the curriculum expectations for their courses, as well as for developing appropriate methods for assessing and evaluating learning. Educators also support learners in developing the reading, writing and oral communication skills needed for success in their mathematics courses.

Educators bring enthusiasm and varied teaching and assessment approaches to the classroom, addressing different learners' needs and ensuring sound learning opportunities for every learner. Van der Horst and McDonald (2003) state that learners need a solid conceptual base and educators strive to create a classroom environment that engages learners' interest and helps them arrive at the understanding of mathematics that is critical to further learning. Van der Horst and McDonald (2003) further emphasise that using a variety of instructional assessment and evaluation strategies, educators provide a number of opportunities for learners to develop skills of inquiry, problem solving, and communication as they investigate and learn fundamental concepts.

The activities offered should enable learners not only to make connections among these concepts throughout the course but also to relate and apply them to relevant societal, environmental, and economic contexts. Opportunities to relate knowledge and skills to these wider contexts - to the goals and concerns of the world in which they live, will motivate learners to learn and to become lifelong learners who are able to connect mathematical knowledge to daily activities. According to Killen (1996), the following instructional procedures should be followed if educators want all of their learners to learn well and to achieve specific outcomes:

- Educators must prepare learners adequately so that they can succeed. They should provide additional time or assistance to learners who need it.
- Educators must create a positive learning environment which has everything which might be needed in the teaching and learning process.
- Educators must help learners to understand what they have to learn, why they should learn it, what future use it will be to them and how will they know whether they have learnt or not.
- Educators must use a variety of methods of instruction in order to help each learner to learn no matter what the learner's most effective learning style might be.

❖ **The Site Manager / Principal**

The site manager works in partnership with educators and parents to ensure that each learner has access to the best possible educational experience. To support student learning, the site manager should ensure that the curriculum is being properly implemented in all classrooms using a variety of instructional approaches. The site manager should also ensure that appropriate resources are made available for both educators and learners. Van der Horst and McDonald (2003) explain that to enhance teaching and learning in all learning areas, including mathematics, the site manager should ensure that learning teams are formed and work with educators to facilitate participation in professional development. It is the site manager's responsibility to ensure that every learner who has learning problems is being assisted through remedial classes and interventions are properly developed, implemented, and monitored.

❖ **Parents / Guardians**

Parents have an important role to play in supporting their children in the learning process. The researcher, based on her daily interaction with learners, experienced that learners perform better in school if their parents or guardians are involved in their education. By becoming familiar with the curriculum, parents can find out what is being taught in the learning areas that their children are taking and what their children are expected to learn. According to Van der Horst and MacDonald (2003), this awareness will enhance parents' ability to discuss their children's work with them, to communicate with educators, and to ask relevant questions about their children's progress.

Knowledge of the expectations in the various learning areas also helps parents to interpret the educators' comments on the progress of their children and to work with them to improve their children's learning. The mathematics curriculum promotes lifelong learning. In addition to supporting regular school activities, parents can encourage their sons and daughters to apply their problem-solving skills to other disciplines and to
real-life situations.

According to Van der Horst and McDonald (2003), the following are examples of effective ways in which parents can support their children in the learning process:

- attending parent-teacher interviews,
- participating in parent workshops,
- becoming involved in school council activities,
- becoming a School Governing Body member, and
- encouraging learners to complete their assignments.

❖ **Learners**

Van der Horst and MacDonald (2003) state that learners have many responsibilities with regards to their learning. Learners who make the effort required to succeed in school and who are able to apply themselves will soon discover that there is a direct relationship between this effort and their achievement, and will therefore be more motivated to work. According to Van der Horst and McDonald (2003), there will be some learners who will find it more difficult to take responsibility for their learning because of the challenges they face. For these learners, the attention, patience, perseverance and encouragement of educators and family members can be important factors for success. Killen (2000:1) as cited in Kwayisi (2006), emphasizes that all children can learn when provided with the appropriate conditions in the classroom.

Van der Horst and McDonald (2003) further acknowledge that taking responsibility for their own progress and learning is an important part of education for all learners, regardless of their circumstances. Mastery of concepts and skills in mathematics requires a sincere commitment to work and study. Learners are expected to develop strategies and processes that facilitate learning and understanding in mathematics. Learners should also be encouraged to actively pursue opportunities to apply their problem-solving skills outside the classroom and to extend and enrich their understanding of mathematics.

2.2.4 Principles of Teaching Mathematics

According to the Department of Education (2003), the six generic principles of mathematics are; equity, the curriculum, teaching, learning, assessment and technology. These principles, if well implemented, may result in an understanding of mathematics thus making it easier for teachers to connect mathematics to daily lives.

2.2.5 Teachers' Qualifications

Mathematically qualified educators should be appointed to teach mathematics. Workshops and mathematical tours should be organised for educators in order to improve their level of teaching mathematics (Mathforum, 2001, on line). The researcher investigated whether educators were qualified or not. According to Ernest (1991), a qualified educator should be in a position to make learning more interesting to learners because of the teaching skills that were acquired during training. The educator should be in a position to know what to teach, how to teach, what type of students are being taught, where and when the teaching process should occur.

2.2.6 The Teaching and Learning of Mathematics

Mathforum (2001, on line) states that teaching skills used by educators should activate the learners' minds in a sense that they overpower all barriers of learning that may cause teaching and learning problems in mathematics. The researcher investigated whether educators were applying interesting teaching methods that would make the teaching and learning environment more interesting to learners thus making learners develop a positive attitude towards mathematics hence developing a better understanding of the application of mathematics to everyday life. According to Mathforum (2001), students become restless and drift off if the teacher speaks for a long period of time therefore it is advisable for educators to use a variety of teaching strategies in order to activate the learners minds and develop an interesting learning environment.

2.2.7 The Aims of Mathematics

According to Ernest (1991), mathematics should be regarded as an essential element of communication. Learners should develop awareness of the fascination of mathematics, imagination, initiation and flexibility of mind. They should acquire the personal qualities of working in a systematic way, independently and cooperatively. They should consider an in-depth study and application of mathematics and have confidence in their Mathematical skills and abilities.

2.2.8 The Structure of Mathematics

Another type of connection that should develop for mathematics learners is an understanding of and appreciation for the uniqueness of mathematics as a discipline, irrespective of context. This exploration of the structure of mathematics happens very slowly for learners. Jones and Bush (1996) identified two types of structures in mathematics. These are conceptual structures and axiomatic structures.

2.2.8.1 Conceptual structures

"Conceptual structures comprise mathematical concepts, their definitions, properties and the relationships among them" [National Council of Teachers of Mathematics (NCTM)], 1989:718). One aspect of exploring conceptual structures is to investigate definitions, which are accepted by mathematicians as true. For example, a square can be defined as a "rectangle with congruent sides." It can also be defined as a "rhombus with one right angle." Are these two shapes equivalent? Is one definition better than another? Is one definition more useful than another? Students of mathematics can be encouraged to define concepts in multiple ways, critique and compare those definitions, and struggle with the difficulty of using language to express mathematical relationships.

Conceptual structures also serve to explicate the relationships among mathematical concepts. For example, when introduced to a new number system, students should be encouraged to investigate "what is gained, what is lost, and what is retained in the structural characteristics of each new system" (NCTM, 1989:185). At the secondary school level, students might be asked to organize the following terms to indicate relationships within the number system (Jones and Bush, 1996:718). "Decimals, whole numbers, zero, irrational numbers, fractions, real numbers, integers, percents, counting numbers, rational numbers, pure imaginary numbers, complex numbers".

Questions like these that focus students' attention on mathematical relationships are crucial if students are to develop an understanding of mathematics that goes beyond superficial parroting of information. Concepts use structures that can be represented in a number of ways, including Venn diagrams, tables, charts, webs or other types of mind maps. The challenge for students (and teachers as well) is the personal struggle to uncover and communicate the mathematical relationships involved.

2.2.8.2 Axiomatic structures

Axiomatic structures are composed of mathematical axioms, postulates, theorems, procedures, rules, formulas, and laws. The purpose of axiomatic structure is to formalize relationships between what is taken to be true about mathematical objects, that is, axioms and postulates; what can be proved about those objects through formal reasoning processes, that is, theorems; and what is used to solve problems, that is, procedures, formulas, and rules (Jones and Bush, 1996:716-717). In mathematics, a statement is said to be true when a logical, step-by-step, coherent argument is provided; false if a counter example to the statement is found; and either true or false otherwise. According to Benson and Vessey (1996: 5), this criterion of mathematical truth is much more precise and formal than what most people generally take as a definition of truth, and it is this criterion that sets mathematics apart from the other sciences.

2.2.9 Assessment in Mathematics

The primary purpose of assessment and evaluation is to improve learners' learning. Information gathered through assessment helps educators to determine learners' strengths and weaknesses in their achievement of the curriculum expectations. This information also serves to guide educators in adapting curriculum and instructional approaches to learners' needs and in assessing the overall effectiveness of programs and classroom practices. According to Van der Horst and McDonald (2003), assessment is the process of gathering information from a variety of sources (including assignments, demonstrations, projects, performances, and tests) that accurately reflects how well learners are achieving the curriculum expectations in a course.

As part of assessment, educators provide learners with descriptive feedback that guides their efforts towards improvement. Evaluation refers to the process of judging the quality of the learners' work on the basis of established criteria, and assigning a value to represent that quality. In order to ensure that assessment and evaluation are valid and reiable, and that they lead to the improvement of learners' performance, educators must use assessment and evaluation strategies that:

- address both what learners learn and how well they learn;
- are based on both the categories of knowledge and skills;

- ❖ are varied in nature, administered over a period of time, and designed to provide opportunities for learners to demonstrate the full range of their learning;
- ❖ are appropriate for the learning activities used, the purposes of instruction, and the needs and experiences of the learners;
- ❖ are fair to all learners;
- ❖ accommodate the needs of learners with special educational needs;
- ❖ ensure that each learner is given clear directions for improvement;
- ❖ promote learners' ability to assess their own learning and to set their own goals;
- ❖ include the use of samples of learners' work that provide evidence of their achievement; and
- ❖ are communicated clearly to learners and parents at the beginning of the school term and at other appropriate times throughout the school year.

2.2.10 Teaching and Learning Theories

Constructivism, behaviourism and cognitivism are theories that are discussed in this study. Behaviourism and cognitivism are the two learning theories that have the word 'change' in their definitions and can be associated with both the educators and learners in the teaching and learning process.

2.2.10.1 Constructivism as a Teaching and Learning Theory

"Constructivism advances the belief that learners do not learn by memorizing facts or processes isolated to their reality. Students do not learn mathematics by hearing or watching the teacher describe computational procedures or mathematical processes. They do not learn by reading definitions of abstract terms. Students learn by seeing, doing and connecting. This view emphasises that the mediator, tool and culture play significant roles in the interaction processes" (Troutman and Lichtenberg, 2003:18). This stresses the importance of knowledge, skills, values and attitudes in the teaching and learning of mathematics. Spady (1988) advices that the work of a constructivist educator in a constructivist classroom, where learners are engaged in an outcomes-based learning process, should be guided by the following principles:

* Learners come to class with an established world-view, formed by years of prior experience and learning.

* Even as it evolves, learners' world-view filters all experiences and affects their interpretation of observations.
* For learners to change their world-view requires work.
* Learners learn from each other as well as the educator.
* Learners learn better by doing.
* Allowing and creating opportunities for all to have a voice promotes the construction of new ideas.

2.2.10.2 Behaviourism as a Teaching and Learning Theory

"Behaviourism is a durable change in behavior" (Troutman and Lichtenberg, 2003:13). Spencer (2004, online) states that behavioural theorists define learning as nothing more than the acquisition of new behaviour, and identify conditioning as a universal learning process. They believe that behaviour is shaped deliberately by forces in the environment and that the type of person and actions desired can be the product of design. In other words, behaviour is determined by others, rather than by our own free will. By carefully shaping desirable behaviour, morality and information is learned.

Learners will acquire and remember responses that lead to satisfying after effects. Spencer (2004, online) emphasises that repetition of a meaningful connection results in learning. If learners are ready for the connection, learning is enhanced; if not, learning is inhibited. Motivation to learn is the satisfying after effect, or reinforcement. Other influential behaviourists include B.F. Skinner (1904-1990) and James B. Watson (1878-1958). Their findings had an impact in behaviourism as a teaching and learning theory.

2.2.10.3 Cognitivism as a Teaching and Learning Theory

Spencer (2004, online), mentions that cognitivists or constructivists believe that the learner actively constructs his or her own understandings of reality through interaction with objects, events, and people in the environment, and reflecting on these interactions. Spencer (2004, online) indicates that for learning to occur, an event, object, or experience must conflict with what the learner already knows. Therefore, the learner's previous experiences determine what can be learned. Motivation to learn is experiencing conflict with what one knows, which causes an imbalance, which triggers a quest to restore the equilibrium. Piaget described intelligent behavior as adaptation. Spencer continue to point out that the learner organizes his or her understanding in organized structures. At the simplest level, these are called schemas. When something new is presented, the learner must modify these structures in order to deal with the new information. Spencer (2004, online) notes that some constructivists (particularly Vygotsky) emphasize the shared, social construction of knowledge, believing that the particular social and cultural context and the interactions of novices with more expert thinkers (usually adults) facilitate the learning process. The researcher's teaching experience emphasizes that the teacher mediates between the new material to be learned and the learner's level of readiness, supporting the child's growth through his or her zone of proximal development.

2.3 IN - AND OUT - OF SCHOOL MATHEMATICS

Nunes (1993) points out that there is evidence of the existence of out-of-school mathematics, that is, mathematics that is different to school mathematics and which is not necessarily learnt in school. According to Carraher (1991), mathematics which exists out of school is shown by the fact that children develop understanding of numbers before they come to school, and adults perform calculations at work. Bishop (1993:15) defines Non-Formal Mathematics Education (NFME) as "an organised, systematic, mathematics education activity carried on outside the framework of the formal system".

NFME activities include adult numeracy, special courses for gifted children, television programmes and vocational training courses. Bishop (1993) contrasts Formal Mathematics Education (FME) with Informal Mathematics Education (IFME) which is mathematical knowledge that is gained informally from, for example, adults in traditional societies or from the media in industrialised societies.

Differences between In – and – Out of School Mathematics are tabulated on the next page.

2.3.1 Differences between In - and Out - of School Mathematics

Harris and Evans (1991:129, on line), provide a description of "informal" mathematics and school mathematics (see Table 2.1 below).

Table 2.1: The differences between informal and school mathematics.

INFORMAL MATHEMATICS.	SCHOOL MATHEMATICS.
▪ embedded in task	▪ decontextualised
▪ motivation is functional	▪ motivation is intrinsic
▪ objects of activity are concrete	▪ objects of activity are abstract
▪ processes are not explicit	▪ processes are named and are the object of study
▪ data is ill defined and noisy	▪ data is well defined and is presented tidily
▪ tasks are particularistic	▪ tasks are aimed at generalization
▪ accuracy is defined by situation	▪ accuracy is assumed or given
▪ numbers are messy	▪ numbers arranged to work out well
▪ work is collaborative, social	▪ work is individualistic
▪ language is imprecise and responsive to setting	▪ language is precise and carefully differentiated
▪ correctness is negotiable	▪ answers are right or wrong

The table above indicates that there is a connection between mathematics and everyday life experiences. The informal mathematics need to be supported by the school mathematics in order for the connection to be exercised.

2.4 MATHEMATICS CONNECTIONS TO EVERYDAY LIFE

Mathematics connections to everyday life refer to how mathematics relates to daily activities and how mathematics is used outside of a career.

2.4.1 Types of Connections

The connections described in this study were organised into three parts:

- interrelationships within mathematics;
- connections between mathematics and other disciplines; and
- application-based connections.

The above-mentioned types of connections are discussed in the following paragraphs.

2.4.1.1 Interrelationships within Mathematics

This type of connection is outlined as follows:

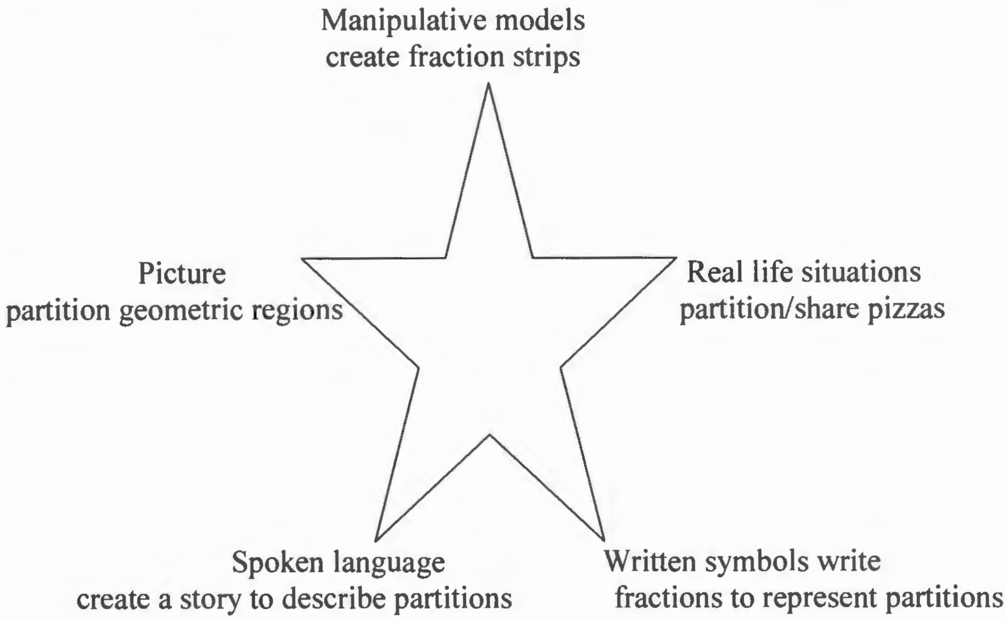
- **Connections within or across mathematical strands**

  Without an explicit focus on connections, students may view their learning of mathematics as the accumulation of unrelated and discrete ideas, and have little understanding of how mathematical ideas are related. Teachers can support the development of these connections through careful unit construction, appropriate questioning, and by using and teaching learners to use devices such as graphic organizers (e.g. concept maps, mind maps, webs, back maps, sorting and classification trees). The intent is to help students gain conceptual understanding that stretches beyond the bounds of one unit of instruction or one grade level.

- **Connections among Representations of a Concept**

  Clements and McMillen (1996:271) emphasise that "Mathematical ideas are ultimately integrated not by their physical or real-world characteristics but rather by how 'meaningfully' connected to other ideas and situations they are". Lesh (1979) discovered that using manipulatives in conjunction with pictorial, verbal, symbolic, and real-world representations can maximize learning. Connections to, and translations between, different representations of a concept are important cognitive processes which lead to a more robust understanding of concepts.

Figure 2.1: The Lesh model to show various representations of fractions.



2.4.1.2 Connections between mathematics and other disciplines

Studying a concept across disciplines brings various perspectives into a unit of study and may be a way to teach students whose strength is in another discipline. There are many mathematical concepts and skills that play a critical role in other disciplines. For example, science, mathematics, and social studies all require students to produce and interpret graphs.

Since the format, terminology, instruction, and grading are approached differently, graphing may be mistakenly perceived by students as a set of distinctly unique skills or processes within each discipline. Concepts which are common or closely related across disciplines offer rich opportunities. Connections that draw together key ideas and topics within or across mathematical strands help students develop a more coherent understanding of the concept or process they are learning. Examples are tabulated in table 2.2 on the next page.

Table 2.2: Connections that draw together key ideas and topics within or across mathematical strands.

LEVEL	Examples of connections among topics WITHIN a content strand	Examples of connections ACROSS mathematical strands
Primary	View plane shapes as the "footprints" of solid shapes	relate numerical patterns to geometric patterns
Intermediate	investigate alternate algorithms that show the relationship of division to subtraction	collect data from circular objects to investigate the value of π
Middle school	recognize and flexibly interchange equivalent fractions, decimals, and percents	use algebraic expressions to communicate the effects of scaling on area and perimeter
High school	use a variety of counting techniques including permutations, combinations, tree diagrams, and matrices	use both algebraic and geometric representations to describe transformations

2.4.1.3 Application-based Connections

Masingila (1995) argues that interdisciplinary studies will often give rise to real-life applications of concepts. Knowing how a concept is applied in the real world increases not only the interest in, but the understanding of, a concept by students. Masingila (1995) further states that application-based connections are designed to help learners relate their learning to issues and contexts outside of school. These connections provide learners with the opportunity to learn and use their knowledge, skills, and understanding in authentic experiences. When mathematics is used in the world outside the classroom there are rarely algorithms or answers provided.

Those who use mathematics in the workplace provide mathematical arguments designed to persuade others of their conclusions. Often one needs to come up with a function or formula that appears to model the data relatively well. This is most often a multi-step process in which attempts are made, then checked, then improved until a reasonably accurate model is developed. Then one attempts to apply this model to solve the problem in question. These activities, in general, form the heart of mathematics. Masingila (1995) emphasises that all students bring to school mathematical knowledge gained from everyday situations they have experienced. However, such knowledge is often hidden and unused in school. Students need in-school mathematical experiences to build on and formalize the mathematical knowledge gained in out-of-school situations.

2.4.2 Code-Switching in the Mathematics Classroom

Setati and Adler (2001) explain that code-switching in a mathematics classroom usually refers to bilingual or multilingual settings, and at its most general, entails switching by educators and/or learners between the language of instruction and the learners main language. Setati and Adler (2001) continue to argue that code switching as a teaching resource has been the focus of a number of studies in mathematics education in the recent past in South Africa.

Adler (1996) states that learners need to talk to learn, and such talking to learn is a function of fluency and ease in the language of communication. Similarly, Mercer (1995) points out that learners need to hear teachers speak in both the language they speak fluently and the language of instruction in classroom situations. In other words, talk is understood as a social thinking tool. According to Setati and Adler (2001), it is not surprising that problems arise when learners' main languages are not used when teachers talk.

Studies carried out by Arthur (1994) in Botswana schools revealed that the absence of appropriate use of the learners' main language in teaching, and delivery of instruction through English only, reduced opportunities for exploratory talk, and thus for meaning-making, and this resulted in misunderstandings when coming to connections between mathematics and everyday life experiences.

2.4.3 Instructional Strategies in Mathematics

Spady (1988) explains that outcomes-based education and constructivism place an emphasis on active modelling, expecting success, intensive engagement, diagnostic assessment and frequent feedback to learners about their performance. According to Killen (1996), the central point of learner-centred education is an unambiguous statement of what learners are to learn. The instructional strategies that support effective learning in mathematics are: problem solving, reasoning and proving, reflecting, selecting tools and computational strategies, connecting, representing and communicating. These strategies are interconnected. Problem solving and communicating have strong links to all the other strategies. A problem-solving approach encourages learners to reason their way to a solution or a new understanding. As learners engage in reasoning, educators further encourage them to make conjectures and justify solutions, orally and in writing.

According to Killen (1996), the communication and reflection that occur during and after the process of problem solving help learners not only to articulate and refine their thinking but also to see the problem they are solving from different perspectives. This opens the door to recognizing the range of strategies that can be used to arrive at a solution. By observing how others solve a problem, learners can begin to think about their own thinking (metacognition) and the thinking of others, and to consciously adjust their own strategies in order to make their solutions as efficient and accurate as possible. The mathematical processes cannot be separated from the knowledge and skills that learners acquire throughout the learning process. Learners must solve problems, communicate, reason, reflect, select, connect, represent and communicate as they develop the knowledge, the understanding of concepts, and the skills required in their learning process.

2.4.4 Mathematics in Social Context

The learning of mathematics has always been associated with the schooling process. That is, it was thought that mathematical concepts and skills were acquired only if one went to school. However, Nunes (1993) points out that analysis of children's mathematical knowledge has led researchers to conclude that mathematical knowledge is also acquired outside the structured systems of mathematics learning such as schools.

Mathematics in a social context refers to the use of mathematical skills outside of schools and the acquisition of mathematical skills other than from schools. Mathematics in social context emphasizes the connection between mathematics and everyday life experiences.

2.4.5 Indigenous Mathematics

Mathematics education is the induction of the young into a part of their culture through the "process of cultural interaction" (Bishop, 1993:4). Bishop uses the terms *enculturation* (ie. induction of a child into their home culture) and *acculturation* (induction of a person into a culture which is different from their home culture). He queries whether a child's induction to "western" mathematics, is a part of the home or local culture. The answer will differ depending on the home background. In some countries, "western" mathematics (school mathematics) and even the notion of schooling is regarded as alien. Bishop (1993:188) cautions against "intentional" acculturation which does not try to preserve the child's home culture. Indigenous games could be used as a connection between mathematics and everyday life experiences. Learners learn to count and play at the same time.

2.4.6 Mathematics in Cultural Context

Dowling (1991) states that the application of mathematics in a variety of contexts is not a new concept. In fact, from the late 1970's the emphasis of mathematics curricula was to show how mathematics was used in a variety of contexts in working and everyday life. What is new is the concept that mathematics can be identified in cultural activities in traditional societies. The researcher investigated the perceptions of teachers when applying mathematical skills to the cultural context. Patterns could be identified in the Zulu / Venda huts which were painted in different colours.

2.4.7 Ethnomathematics

According to Harris (1991), ethnomathematics is an activity which is practised in socio- cultural groups. "It is the mathematics which is practiced among identifiable cultural groups, such as national - tribe societies, labor groups, children of certain age brackets and professional classes may include mathematics as practiced by engineers, which does not respond to concept of rigour and formalism. Builders, well diggers, shack raisers in the slums, also use examples of ethnomathematics" (Harris, 1991:15).

According to Presmeg (1996), studies of "ethnomathematics" or "cultural mathematics" (CM) over the last decade have created an awareness of and provided evidence of the "other mathematics" which is "out of school" and is distinct from school mathematics. However, the impact of CM on the curriculum is not at all clear. Issues that were addressed include these questions: Should this "other mathematics" be taught in schools? Should we include it in the school curriculum? If so, how should it be used? These questions and issues can be seen as part of the overall debate about what knowledge to include or exclude from the curriculum.

2.4.8 Ideologies of Education

Below are five main ideologies of education:

2.4.8.1 Progressivism

According to Houghton (2005), progressive education is a broad movement for educational reform in the twentieth century. Houghton (2005) states that educational progressivism is the belief that education must be based on the fact that humans are social animals who learn best in real-life activities with other people. Progressivists claimed to rely on the best available scientific theories of learning. Most believed that children learned as if they were scientists, following a process similar to John Dewey's model of learning (World Book, 2004, on line). According to World Book (2004, on line), the following points are the problem-solving steps that should be taken into consideration when one is faced with a problem-solving situation.

1. Become aware of the problem.
2. Define the problem.
3. Propose hypotheses to solve it.
4. Evaluate the consequences of the hypotheses from one's past experience.
5. Test the most likely solution.

Given this view of human nature, World Book (2004, on line), emphasises that a progressivist teacher desires to provide not just reading and drilling, but also real-world experiences and activities that centre on the real life of the students.

A typical progressivist slogan is "Learn by Doing!" World Book (2004, on line), further states that in 1957, the launch of Sputnik caused a panic in educational establishments as Americans and Europeans felt they had fallen behind the Soviet Union technologically. A rethinking of education theory followed, that caused progressivism to fall from favour. However, today some schools use progressive education methods, such as hands on activities and science experiments.

2.4.8.2 Instrumentalism

Houghton (2005) points out that this is a pragmatic philosophy which holds that it is the function of thought to be a means to the control of environment, and that the value and truthfulness of ideas is determined by their usefulness in human experience or progress. Houghton (2005) further states that in the philosophy of science, instrumentalism is the view that a concept or theory should be evaluated by how effectively it explains and predicts phenomena, as opposed to how accurately it describes objective reality. Instrumentalism relates closely to pragmatism.

2.4.8.3 Reconstructionism

Houghton (2005) states that reconstructionism conceives education as an important way of moving society in desired directions and that social reconstructionism is a philosophy which emphasizes the addressing of social questions and a quest to create a better society and worldwide democracy. Houghton (2005) further emphasizes that reconstructionist educators focus on a curriculum that highlights social reform as the aim of education. Houghton (2005) also states that critical theorists, like social reconstructionists, believe that systems must be changed to overcome oppression and improve human conditions.

According to Houghton (2005), Paulo Freire (1921-1997) was a Brazilian whose experiences living in poverty led him to champion education and literacy as the vehicle for social change. In his view, humans must learn to resist oppression and not become its victims, nor oppress others. To do so requires dialogue and critical consciousness, the development of awareness to overcome domination and oppression.

Houghton (2005) further states that Freire saw teaching and learning as a process of inquiry in which the child must invent and reinvent the world rather than "teaching as banking," in which the educator deposits information into students' heads.

World Book (2004, online) states that for social reconstructionists and critical theorists, the curriculum focuses on student experience and taking social action on real problems, such as violence, hunger, international terrorism, inflation, and inequality. Strategies for dealing with controversial issues such as inquiry, dialogue, and multiple perspectives are the focus. Community-based learning and bringing the world into the classroom are also strategies. Educators should become reconstructionsts through their guidance in showing learners the connections between mathematics and everyday life (World Book, 2004, online). Based on the study, this practice will bring reform in the society.

2.4.8.4 Classical Humanism

According to Spencer (2004, on line), the roots of humanism are found in the thinking of Erasmus (1466-1536), who attacked the religious teaching and thought prevalent in his time to focus on free inquiry and rediscovery of the classical roots from Greece and Rome. Erasmus believed in the essential goodness of children, that humans have free will, moral conscience, the ability to reason, aesthetic sensibility, and religious instinct. He advocated that the young should be treated kindly and that learning should not be forced or rushed, as it proceeds in stages. Spencer (2004, on line), states that humanists believe that the learner should be in control of his or her own destiny. Since the learner should become a fully autonomous person, personal freedom, choice, and responsibility are the focus.

The learner is self-motivated to achieve towards the highest level possible. Motivation to learn is intrinsic in humanism. Spencer (2004, on line) emphasizes that educational humanists believe that "the best studies, for the best kids" are "the best studies for all kids'. While humanism as an educational current was widely supplanted in the United States by the innovations of the early 20th century, it is still found in some school disciplines. According to Spencer (2004, on line), recent applications of humanist philosophy focus on the social and emotional well-being of the child, as well as the cognitive.

Development of a healthy self-concept, awareness of the psychological needs, helping students to strive to be all that they can are important concepts that are found in classrooms today. Teachers emphasize freedom from threat, emotional well-being, learning processes, and self-fulfillment.

2.4.8.5 Liberal Humanism

Liberal humanism acknowledges that the importance of intellectual disciplines for all learners seeks to create a common culture. It is undeniable that, as Paliwala (2002, on line) points out, there are distinct winds of change in the geography and political economy of learning, which are likely to have deep impacts in the future. "Learning beyond the classroom is changing as a result of digitised libraries, courseware and electronic communications. Increasing global flows of students induce a different change in learning spaces. At the same time the growth of distance learning challenges the concept of campus universities. Learning times also change with development of asynchrous and synchronous extra-classroom interaction whether in on - site or distance learning environments" (Paliwala, 2002: 185).

If such developments are inevitable the question is how to maximise their value for effective learning. Paliwala (2002:202) concludes by calling for more attention to be given to educational theory, arguing that, "Effective use of technology requires careful attention to pedagogic as well as technical issues". Effectiveness in this area, it is suggested, requires a preliminary sustained intellectual reflection on the nature of learning, an appreciation of current theories of knowledge and an understanding of what universities are for. Barnett (2003:62) states: "If communities can come to understand themselves and motivate themselves through ideologies that have limited or even deleterious effects, they can also come to understand and motivate themselves through ideologies that have positive effects. And so it is on campus. If ideology cannot be extinguished on campus, let its expression include virtuous ideologies that are likely to further the project of the university". Cownie (1999:54) indicates however that her enthusiasm for a theoretical approach to legal education is not widely shared among educators. "Educators should not only be familiar with the philosophy and theory of education, but should also be able to put them into practice, to integrate them into our teaching methods".

2.5 CAREERS IN MATHEMATICS

"A career in mathematics is extremely rewarding and studying mathematics will open doors you never dreamed of" (SAMF, 2008:21). Learners should spend more time practicing mathematics, bearing in mind that mathematics is needed for job opportunities. The researcher investigated if teachers were able to make connections between mathematics and different careers. "So what do you do with a degree in mathematics? Actually, just about anything! Even if you do not choose a career in the mathematical sciences, studying as much mathematics as you can is a good way to keep your career options open and gives you an excellent foundation for working in all areas of science and engineering, just to mention a few" (SAMF, 2008:1). According to SAMF (2008), mathematics has an opportunity to make a lasting contribution to society by helping to solve problems in such diverse fields as medicine, economics, finance, biology, computer science, physics, psychology, engineering and social science- even politics.

2.6 INFLUENCE OF SOCIETY TOWARDS MATHEMATICS

Mathforum (2001) points out that educators, learners, parents, peers, community members and the environment are factors that have an influence on the study of mathematics. The researcher investigated how the above-mentioned factors affect the teachers' perceptions in making connections between Mathematics and everyday life experiences. According to the researcher, the influence can either be positive or negative depending on the attitude of society towards mathematics and its connections to everyday life experiences.

2.7 SYNTHESIS

This chapter involved the review of related literature, why the researcher conducted a literature review and how relevant literature was identified. Philosophical and theoretical underpinnings, theories underlying the research and mathematics connections to everyday life were also discussed.

Research design and methodology will be discussed in the next chapter.

CHAPTER 3

RESEARCH DESIGN AND METHODOLOGY

3.1 INTRODUCTION

The objective of this chapter is to discuss the research design and methods, the instruments used and the population that participated in the study. A description of the philosophical and learning theories that underpinned the research together with the administration of questionnaires, how data was collected and how the research questions were structured and answered are also outlined.

3.2 RESEARCH QUESTIONS

The structure of the research questions are discussed in the following paragraph:

The questions were structured in such a way that it became easy for the researcher to determine whether educators understood the meaning of the connections between mathematics and everyday life or not. The answers for these questions were found through classroom observations, whereby the researcher observed the presentation of the lesson, interviews in which the educators gave their point of view towards the questions and questionnaires whereby the educator had to tick the activities which showed the connections of mathematics to everyday life experiences.

3.3 RESEARCH DESIGN

Survey research was used to collect data on the teachers' perceptions in making connections between mathematics and everyday life. Wiseman (1999:5) explains survey research as a systematic collection, analysis, interpretation and report of pertinent facts and findings about the current status of persons, processes, products or programmes. Wiseman (1999) further emphasises that this can be done through observations, the use of interviews and written questionnaires and that information is gathered with a view towards identifying relative strengths and weaknesses of topics under study. De Vos (2000) elaborates further that a survey research is a process of collecting data from a representative sample to infer attributes of the population.

According to Denscombe (2005), the main purpose of a survey is to estimate with significant precision the percentage of population that has a specific attribute by collecting data from a small part of the total population. Cohen, Manion and Morrison (2000), state that advantages of using a survey to conduct a research are because it is economical, sufficient, generates numerical data and represents a wide target population.

3.4 RESEARCH METHODS

Both qualitative and quantitative methods were used in this study. The explanation, the importance and other researchers' views about qualitative and quantitative research methods are outlined in the following presentation.

3.4.1 Qualitative Research Method

According to the National Statistics Department (2005), qualitative methods play an important role in developing, maintaining and improving survey quality by assessing vital issues that surveys alone may not address. This method aims at understanding the meaning that learners attach to their daily learning experiences. It is humanistic and it involves field work (Denzin, Norman and Lincoln, 2000). It is a method which uses data in the form of a respondent's own words. Qualifying words were used and the researcher obtained first-hand information in this study.

An advantage of the Qualitative research method is that no collected information was lost because of the use of observations, interviews and questionnaires. The questionnaires were distributed and collected on a specified date, and arrangements for the observations and interviews were made. Both observations and interviews were conducted and first-hand information was collected and analysed. Qualitative research method is an inductive research in a sense that the researcher used data analysis to develop concepts, insights and understanding. It involves field work as stated by Denzin et al. (2000). The researcher visited schools in order to select educators who participated in the study.

3.4.2 Quantitative Research Method

Quantitative research method uses numerical data. It relies on measurements and uses scales. Zikmund (2003) points out that researchers use quantity or measurement to compare and analyse data. For example, the answers to the questionnaire and interviews were collected, interpreted and analysed. Quantitative research is deductive. McDonald and Wisdom (2003), emphasise accessibility, validity and reliability, in quantitative research methods. The researcher should ensure that the selected population is reliable, easily accessible and the information received is valid to assist in the study. Kwayisi (2006:75) explains that quantitative research is involved with data, which often include quantification statements such as, 'more than', 'less than', 'most' as well as specific numbers. He continues to state that quantitative approaches can collect qualitative (non-numeric) data through open-ended questions.

3.5 POPULATION AND SAMPLING

Neuman (1991:145) states that population for research purposes is a large pool of cases or elements. Agreeing with Neuman, Denzin et al. (2000) state that population for research purposes is a complete set of events, people or things to which the research findings are to be applied. Mathematics educators from schools in the Mafikeng Area Project Office (APO) were randomly selected to participate in the study. The total number of 58 educators was chosen. Purposive sampling was implemented. According to Kwayisi (2006:82), purposive sampling is a selection that is done with a specific purpose in mind: "to reflect the qualities of the people and their relevance to the topic of the investigation".

3.5.1 Population

A random selection of schools around the Mafikeng APO was conducted. A target population of the research consisted of mathematics teachers around Mafikeng area. A total number of 58 mathematics educators formed the population for the research but only 44 responded to the questionnaires. There was no minimum estimation of participants because the number of mathematics educators in different schools was not the same.

3.5.2 Sample and Sampling Procedures

Denscombe (2005) explains a sample as a small portion of the whole – a small group of individuals who will participate in the research. Sampling strategies that were used in this study were simple random and purposive sampling. Cohen et al. (2000) state that simple random sampling is used when the population is small and each member of the population has an equal chance of being selected and the sample contains subjects with characteristics similar to the population as a whole.

3.5.2.1 Purposeful sampling

The selection of teachers to be interviewed depended on, firstly, teachers who were to be identified from the questionnaire as having strong "internal" views (conceptions) about the connection of mathematics to everyday life, and teachers who held strong "external" views. Further selection was to be determined by the location of the school region (urban /rural) and the gender of the educators. The total number to be interviewed was six, one from each of the six selected schools.

Purposive sampling, according to Kwayisi (2006:82), is the sample that is hand-picked for the research. He explains that it is a selection that is done with a specific purpose in mind: 'to reflect the qualities of the people and their relevance to the topic of the investigation'. The questionnaire was distributed to 15 schools but only 12 schools responded.

The table on the following page displays the schools and the number of educators who responded to the questionnaires.

Table 3.1 Educators who responded to the questionnaires

SCHOOL	NUMBER OF EDUCATORS WHO RESPONDED TO THE QUESTIONNAIRES
A	3
B	3
C	3
D	3
E	4
F	2
G	5
H	3
I	2
J	5
K	5
L	6
TOTAL	**44**

Out of the 58 educators who were given the questionnaires, only 44 educators completed and returned the questionnaires. Table below shows the number of educators who were observed and interviewed.

Table 3.2: Educators who were observed and interviewed

SCHOOL	NUMBER OF EDUCATORS WHO WERE OBSERVED AND INTERVIEWED
A	1
B	1
C	1
D	1
E	1
F	1
TOTAL	**6**

The above table indicates that only six educators were observed and interviewed. This indicates that triangulation was done only on six educators.

3.5.3 Response rate

The response rate for educators who answered the questionnaire was calculated as indicated below, adapted from Seeletse (2005:41):

3.5.3.1 Response rate for educators who answered the questionnaire

* Number of educators who were expected to participate in the study = 58.

* Number of educators who responded to the questionnaire = 44.

The response rate was 0,76. This was calculated by dividing the number of educators who responded to the questionnaire by the number of educators who were expected to participate in the study. The percentage of the number of educators who were expected to participate in the study to those who responded to the questionnaire was 76%. This percentage was calculated by multiplying the response rate by 100%. The calculations indicated that only 76% of the population responded to the questionnaires. This was a fair representation of the population.

3.5.4 Sampling fraction

According to Seeletse (2005:41), sampling fraction should be calculated as indicated below:

3.5.4.1 Sampling fraction for educators who were observed and interviewed

* Number of educators who responded to the questionnaire = 44

* Number of educators who were observed and interviewed = 6.

The sampling fraction was 0,14. This was calculated by dividing the number of educators who were observed and interviewed by the number of educators who responded to the questionnaire. The percentage of the number of educators who were expected to participate in the study to those who responded to the questionnaire was 14%. This was calculated by multiplying the sampling fraction by 100%.

The calculations indicated that 14% of the population were chosen to be observed and interviewed. This implies that the triangulation research method was exercised on 14% of the participants. This was an indication of a fair representation of the population because observations and interviews were the most challenging part of this study.

3.6 RESEARCH INSTRUMENTS

Ways of gathering information were observations, interviews and questionnaires. An advantage of the above-mentioned instruments is that first-hand information was collected thus making the research to be a true reflection of the educators' perceptions towards the application of mathematics to everyday life experiences.

Observations were done during school hours in the classroom. Structured interviews were conducted immediately after the classroom observation. This type of interview is an organised way of getting information (Welman and Kruger, 2001). It was formal because a list of questions was prepared for the participants concerning mathematics and its connection to everyday life (see Appendix G1). An advantage of structured interviews was that the researcher got first-hand information. Questionnaires were also used in the study (see Appendix E). This was the best method of getting information for the reason that the researcher handed them over to literate people (educators). The questionnaires were delivered to schools and given to mathematics educators with special consideration as to balance in race, age and gender.

3.7 EMPIRICAL INVESTIGATIONS

Observations, interviews and questionnaires were used as data collection instruments. This is how they were incorporated into the study:

3.7.1 Observations

Denscombe (2005:139) states that observation offers the researcher a distinct way of collecting data and that it does not rely on what people say, do, or think. Denscombe further clarifies that it is more direct in that, it draws on the premise that it is best to observe what actually happens. Classroom observations were conducted, and that was a way of collecting data on the teachers' perceptions to connect mathematics to everyday life.

3.7.2 Interviews

According to Denscombe (1983), as cited in Denscombe (2005:109), interviews involve a set of assumptions and understandings about the situation which are not normally associated with a casual conversation. Face-to-face interviews were conducted to investigate the teachers' views concerning the connection of mathematics to everyday life.

3.7.3 Questionnaires

According to De Vos (2000) a questionnaire is a device which enables respondents to answer questions. A questionnaire was designed and a pilot-test was conducted before giving it to the educators. The aim of the questionnaire was to obtain information about the teachers' perceptions in making connections between mathematics and everyday life.

The teachers' views on the impact that they had in making connections between mathematics to life in general was given special consideration. The questionnaire was adapted from a thesis online which examined the beliefs of Papua New Guinea secondary school teachers about school mathematics and cultural mathematics and how these beliefs were manifested in their classroom practices.

3.7.4 Data Analysis

Qualitative and quantitative methods were used to analyze data. Computation of frequencies, percentages, tables, figures, Spearman's correlation and analysis of variance were used for the statistical analysis of data.

To analyse data the researcher made use of the Statistical Package for the Social Sciences (SPSS) through the help of a statistician. "SPSS is a statistical program in the social sciences, which is most widely used. An advantage of using this package is that it enables the researcher to score and analyse quantitative data very quickly and in many different ways" (Brymna and Cramer, 1994:17).

3.7.5 Triangulation

Triangulation is a way of getting alternative and divergent viewpoints on research findings or the research process (Christie, 1997:35). According to De Vos (2000), triangulation involves using different research methods to test the same finding and he considers this valuable as it establishes the validity of the research findings. This method was used in the study in order to find out if the data collected from the questionnaires, interviews and observations was the same or not, concerning the teachers' ability to make connections between mathematics and everyday life. The triangulation method of collecting data was planned in such a way that the researcher first observed then requested the educators to sacrifice ten minutes of their time for an interview and thereafter gave the educators the questionnaire. Due to work demands and other personal constraints, the researcher had to distribute the questionnaires first then make arrangements to conduct observations and interviews. In one of the sampled schools, observation and interview was done on a Saturday during the Saturday classes.

3.8 DATA COLLECTION

Classroom observations, questionnaires and interviews were the tools used for data collection.

3.8.1 Classroom Observations

The observations were to establish the status of classroom practice ie. find out what practice goes on in the classroom to see if there were any differences in the practices of those with differing views about the connections of mathematics to everyday life. An arrangement in the form of an appointment was made between the researcher and the educator and everything concerning the purpose of my visit was explained to the educator.

A consent form (see Appendix D) was handed over to the educator to read and sign. Classroom observations were an integral part of the research because it was important to observe teacher practices in the classroom. Thompson (1992:134-135, on line) suggests that any investigations of teacher beliefs should use verbal data and should also include observational data on instructional practice or mathematical behaviour.

The observations were unstructured although an observation schedule was used as a guideline to maintain uniformity in the main points that the researcher was looking for in the lessons that were observed. Classroom observations were done during lesson presentation. The purpose for classroom observations was to witness if educators were able to demonstrate the connection of mathematics to everyday life in their lessons. An observation schedule (see Appendix G1) and an observation form (see Appendix G2) were used to assess the observation process.

❖ **Advantages of an observation**

Listed below are the advantages of an observation (Denscombe, 2005:146).

- **Direct data collection.** It directly records what people do, as distinct from what they say they do.
- **Systematic and rigorous.** The use of an observation schedule provides an answer to the problems associated with the perception of observers, and it appears to produce objective observations.
- **Efficient.** It provides a means to collect substantial amounts of data in a relatively short time span.
- **Pre-coded data.** It produces quantitative data which are pre-coded and ready for analysis.
- **Reliability.** When properly established, it should achieve high levels of inter-observer reliability in the sense that two or more observers using a schedule should record similar things.

3.8.1.1 Types of observations used in the study

Systematic and participant observations were implemented. Denscombe (2005:140), emphasises that these types of observations are acutely sensitive to the possibility that the researcher's perceptions of situations might be influenced by personal factors and that the data collected could thus be unreliable.

3.8.1.2 Systematic observation and observation schedules

According to Denscombe (2005), the whole purpose of the schedule is to minimize and possibly eliminate the variations that will arise from data based on individual perceptions of events and situations. Its aim is to provide a framework for observations which all observers will use and which will enable the researcher to:

- be alert to the same activities;
- record data systematically and thoroughly; and
- produce data which are consistent between observers, with two or more researchers who witness the same event recording the same data.

3.8.2 Questionnaires as a research tool

Questionnaires were given to the educators via the site manager through the permission of the Department of Education. These were given to mathematics educators only, the reason being to gather general information about the educators and their views to the connection of mathematics to everyday life. Some educators completed the questionnaires immediately while others needed a day or two to complete the questionnaires.

A questionnaire is a device which enables respondents to answer questions. According to Borg (1993), the rules on how to design a questionnaire are the following:

- Short items are preferable.
- Negative items should be avoided.
- Double-barrelled items should be avoided.

According to De Vos (2000), the following points should be taken into consideration when designing a questionnaire:

- Questions should not be long.
- Questions should be clear and in simple language.

❖ **Advantages of questionnaires (Denscombe, 2005:105)**

A questionnaire was used because of the following advantages:

- It is easy to arrange.
- It supplies standardized answers.
- Information from respondents can be obtained in a short period of time.

❖ **Disadvantages of a questionnaire (Denscombe, 2005:106).**

The following are the disadvantages of using a questionnaire as a research tool:

- Impersonal : might cause frustration to some respondents.
- Non-response rate is common. Pre-coded questions can be frustrating for respondents and thus deter them from answering.
- Most of the questionnaires might be spoilt because of careless respondents.

3.8.2.1 Design of the questionnaire

The design of the questionnaire for this study was based on mathematics in general, that is, the structure, the teaching, the teachers' roles, daily activities and mathematics connections to everyday life.

The questionnaire had the following contents:

- Demographic details of the educators and schools. It was important for the researcher to know the background of the schools and the educators who were participating in the study.
- The applications / connections of mathematics to everyday life. This was made up of the following sub-topics:
    - The structure of mathematics,
    - The teaching of mathematics,
    - The teachers' roles,
    - Challenges encountered by teachers in their attempt to connect mathematics to everyday life, and

- Suggestions of educators on how to improve the teaching and learning of mathematics, thus making it easy to connect mathematics to everyday life.

3.8.2.2 Development of questionnaire items

- The main aim of the questionnaire was to gather information on the teachers' ability to make connections between mathematics and everyday life.
- The format and contents of the questionnaire were structured in such a way that they were divided into sections based on their foci (see Appendix E).
- There was a section which was used to gather the biographical information about the respondents. Another section was based on the application of mathematics to real life situations.
- There was also a section of open-ended questions whereby the respondents wrote their views in brief on the application of mathematics to everyday life.

3.8.2.3 Types of questions

Closed and open – ended questions were used in this study and they are discussed in the following paragraphs:

- "Closed – ended questions structure the answers by allowing only answers which fit into categories that have been established in advance by the researcher. The researcher in this case, instructs the respondents to answer by selecting from a range of two or more options supplied on the questionnaire" (Denscombe, 2005:101).
- According to Denscombe (2005:101), open – ended questions are those that leave the respondent to decide the wording, the length and the kind of matters to be raised in the answer. The questions tend to be short and the answers tend to be long.

According to Denscombe (2005), questionnaires vary in terms of their purpose, size and appearance. To qualify as a research questionnaire, however, they should:

- Be designed to collect information which can be used subsequently as data for analysis.

- Consist of a written list of questions. The important point here is that each person who answers the particular questionnaire reads an identical set of questions. This allows for consistency and precision in terms of the wording of the questions, and makes the processing of the answers easier.
- Gather information by asking people directly about the points concerned with the research. Questionnaires work on the premise that the researcher gets the information straight from the horse's mouth.

3.8.3 Interviews

A copy of the interview schedule is included as Appendix F1 in this study. The interviews were intended to validate the information acquired from the questionnaire. According to Thompson (1992, online), interviews are included in the methods because interviews give the researcher the opportunity to do further investigations. If the teachers' responses to the questionnaire indicate contradictions, the researcher can seek clarifications in an interview.

Interviews also give the respondents opportunities to respond in a number of ways. Interviews followed immediately after classroom observations. A voice recorder was used in order to capture exactly what the interviewee said concerning the connection of mathematics to everyday life. A list of questions was formulated and an interview form (see Appendix F2) was completed by the interviewer based on the responses of the interviewees.

3.8.3.1 Type of Interview used in the study

Structured interviews were used in the study. Denscombe (2005:112) points out that structured interviews involve tight control over the format of the questions and answers. It is administered face-to-face with the respondent and each respondent is faced with identical questions. The researcher read the questions from the interview schedule.

3.8.3.2 Interview Skills

The listed points below are interview skills as mentioned by Denscombe (2005:124):

- **The good interviewer is sensitive to the feelings of the interviewee.**

- Denscombe (2005) points out that where the interviewer is able to emphathise and gauge the feelings of the interviewee, then the researcher stands a better chance to coax out most of the relevant information.

- **The good interviewer needs to be attentive**. This may sound obvious, but it is easy to lose track of the discussion because the researcher had to do other things while listening to the interviewee. Things like writing field notes, looking for relevant non-verbal communication and checking if the recorder is working.

- **The good interviewer is able to tolerate silences**. Anxiety is the main danger and silence can be used as a wonderful resource during interviews.

- **The good interviewer is adept at using probes**. There are occasions during interviews when the interviewer might want to delve deeper into a topic rather than let the discussion flow on to the next point. An interviewee might make a point in passing which the researcher thinks should be explored in more detail (see table 3.3).

- **The good interviewer is good at using prompts**. Research interviews are not police interviews. The idea is to nudge the informant gently into revealing information on a specific point (see table 3.3).

- **The good interviewer is adept at using checks**. One of the advantages of an interview is that it offers the researcher an opportunity to check if he or she understood the informant correctly (see table 3.3 in the next page).

3.8.3.3 The Tactics for Interviews

The tactics for interviews are outlined in the following table:

Table 3.3: The tactics for interviews (Denscombe, 2005)

Tactics for Interviews	**Prompts, Probes and Checks**
Remain silent	Prompt
Repeat tne question	Prompt
Repeat the last few words spoken by the interviewee	Prompt

Offer some examples	Prompt
Ask for an example	Probe
Ask for clarification	Probe
Ask for more details	Probe
Summarise thoughts e.g. "so if I understand you well..."	Check

The analysis of questionnaires, observations and interviews is done in chapter 4 of this study and was based on all of the above-mentioned points. Educators felt free to tell their names but for the sake of confidentiality, pseudonyms were used in the analysis and inferences made in chapter 4.

3.9 VALIDITY OF INSTRUMENTS

Validity is the degree to which an instrument actually measures what it is supposed to measure (Bless and Higson - Smith, 2000:157). The triangulation method of collecting data was used in this study to ensure validity of data. Validity of instruments was achieved because through the triangulation method, the researcher was able to collect relevant data which was important for the study.

3.10 ADMINISTRATION OF INSTRUMENTS

The instruments used in the study were administered as follows:

3.10.1 Observations

Classroom observations were fixed based on the dates and times agreed upon by the researcher and the concerned educators. They were done during the normal school day. The researcher had one instance whereby an observation was conducted during an extra Saturday class. Relevant information was recorded by the researcher in the observation schedule form (Appendix G2). Observations were done from July to August 2009.

3.10.2 Interviews

Interviews were fixed based on the dates and times agreed upon by the researcher and the concerned educators. They were done during the day in normal school hours, immediately after the observation. As mentioned in the observation paragraph above, the researcher had one instance whereby an interview was conducted during an extra Saturday class. A voice recorder was used for the researcher to get first hand information. Responses were recorded by the researcher in the interview schedule form (Appendix F2). interviews were also done from July to August 2009.

3.10.3 Questionnaires

A written permission to conduct research in Mafikeng APO schools was granted by the APO manager. Permission was also obtained from the school principals allowing the researcher to conduct the research in their schools. In most schools, reference was made to the Head of Department of mathematics (HOD), then the HOD referred the researcher to mathematics educators. In one of the schools, the researcher was fortunate to find that the principal was a mathematics teacher and was willing to participate in the study. Questionnaires were distributed and appointments were made for the collection of responses, classroom observations and conduction of interviews. Data were collected from July to September 2009.

3.11 ETHICAL CONSIDERATIONS

Letters requesting permission to conduct the study were written. Confidentiality was maintained throughout the study. No names of schools or educators were used in the study. Racial discrimination was by all means avoided. A balance in gender choice was maintained and no educator was harmed or forced to participate in the study.
Ouyang (2006:2, on line), as cited by Kwayisi (2006:140), refers to the following three ethical principles that must be observed in research;

- That the subject should not be harmed in any way,
- That the subjects' privacy should be strictly confidential, and
- That the respect and dignity of participants must be kept at all times.

Leedy and Ormrod (2001:107) emphasise that the following pillars of ethical considerations should be given special attention:

- **Informed consent.** Clark-Carter (2004:14) states that consent should be obtained from the participants (see Appendix D).

- **Voluntary participation.** Clark-Carter (2004:14) explains that potential participants have the right to refuse. They must be approached politely and their rejection should be accepted.
- **Professionalism.** Leedy and Ormrod (2001:107) warn the researcher that the use of other writer's words and ideas without full acknowledgement constitutes plagiarism and it is unprofessional.
- **No harm to respondents.** Bless and Higson-Smith (2000:100) point out that scientists should not subject respondents to harmful or uncomfortable situations.
- **Anonymity and confidentiality.** According to Clark-Carter (2004:15), all participants should be assured of confidentiality and anonymity.
- **No cheating.** Leedy and Ormrod (2001:108) emphasise that researchers must report their findings with honesty.

3.12 PLAN OF THE STUDY

The study was divided into three phases: the submission of the proposal, collection of data and the report writing. Plan of the study is displayed in table 3.4 in the next page.

Table 3.4: Plan of the study

PLANNED ACTIVITY	MONTH IN 2009
Submission of the proposal	June
Submission of the letter to the DoE	June
Submission of the letter to the principals	June
Distribution of the questionnaires	July
Observations and Interviews	July – August
Submission of the First Draft	October
Submission of Final Report for Examination	November

3.13 RESEARCH ASSUMPTIONS

The assumptions for the study were that:

- The participants were professionally qualified teachers.
- The participants taught learners who could construct meaning and understanding.
- The participants would at all times be truthful in their responses.

3.14 PERMISSION TO CONDUCT THE RESEARCH

Letters were written to the APO manager and school principals by way of requesting permission to conduct a research at the Mafikeng area and the selected schools (see Appendices A and C). The letters were delivered by the researcher to the APO and the selected schools.

3.15 RESPONSES OF WRITTEN LETTERS

A written response was received from the APO manager allowing the researcher to conduct the study in schools around Mafikeng APO area (see Appendix B). Questionnaires were collected from the participants, observations and interviews appointments were kept. The collected information was analyzed (see chapter 4 of this study) and the educators' responses were generalised.

3.16 STATISTICAL TECHNIQUES

In the analysis of data, statistics such as frequency tables and percentages, tables, figures and statistical inferences were used to analyse the results of this study.

3.17 SYNTHESIS

The survey questionnaire was used as the main instrument for data collection to determine the teachers' perceptions to make connections between mathematics and everyday life. Chapter 3 involved discussions on what survey is, the population, the sample, design and methods that were used to conduct the study.

Data analysis and interpretation will be discussed in the following chapter.

CHAPTER 4

DATA ANALYSIS AND INTERPRETATION

4.1 INTRODUCTION

This chapter outlines the findings of the study based on the questionnaire. A description on how data were analysed and interpreted is done in this chapter and the analysis of data was in frequencies (F), percentages (%), tables, bar graphs and pie charts and statistical inferences. Questionnaires were distributed to fifty-eight (58) educators but unfortunately only forty- four (44) were able to complete and submit the questionnaires. Data was collected from the 44 educators. The participants' responses were 100% complete meaning that all the 44 questionnaires were well done. They were properly completed and returned. The responses which were collected through questionnaires were summarised and discussed.

4.2 ANALYSIS OF QUESTIONNAIRES

The results of the educators' responses to the distributed questionnaire on the teachers' perceptions in making connections between mathematics and everyday life were organised and presented as tables of frequencies and percentages. Bar graphs and a pie chart were drawn to give a graphical representation of the analysed results. Statistical analysis was also used to give a clear explanation of the teachers' perceptions in making connections between mathematics and everyday life experiences.

- **Gender**

  The table below displays the number of male and female educators who participated in this study.

Table 4.1 Demographic Data

Gender	**Frequency**	**Percent**
Male	28	64
Female	16	36
Total	**44**	**100**

According to table 4.1 above, there were more males than females. This explains that there were more males in schools who were specialists in the teaching of mathematics.

- **Age Category of Educators**

  The participants were not of the same age. The table below shows the age category of educators who answered the questionnaire.

Table 4.2 Age Category of Educators

Age Category	Frequency	Percent
25 – 29	5	11
30 – 39	20	46
40 – 49	12	27
50 – 59	6	14
60 and above	1	2
Total	**44**	**100**

Table 4.2 above indicates that the majority of the mathematics educators, 46%, were aged between 30 and 39 years. Twelve out of 44, 27% were between 40 and 49 years of age. It is interesting to acknowledge the fact that there were 5 (11%) young mathematics educators aged between 25 and 29, and 7, which is 16%, of mathematics educators aged from 50 and above. This was an indication that age was just a number when it came to the teaching of mathematics, both old and young teachers could teach mathematics.

- **Professional Status**

  The educators who participated in the study were all professionally qualified. See the table below.

Table 4.3 Professional Status of Educators

Professionally Qualified	Frequency	Percent
Professionally qualified teachers	44	100
Not professionally qualified teachers	0	0
Total	**44**	**100**

Table 4.3 on the previous page indicates that 100% of the educators were professionally trained mathematics educators.

- **Educators' Qualifications**

  Participants had different qualifications and they are outlined in the table below.

Table 4.4 Educators' Qualifications

Qualification	**Frequency**	**Percent**
Diploma Certificate	12	27
Advanced Certificate	8	18
Bachelor Degree	11	25
Honours	10	23
Masters	3	7
Total	**44**	**100**

Table 4.4 above indicates that 12 out of 44 of the participants, which is 27%, were in possession of a teaching diploma with mathematics as their area of specialisation. Eighteen percent of the respondents improved their qualifications by studying further and received an Advanced Certificate in Education. This meant that 18% of the educators upgraded their mathematics knowledge and skills through the achievement of the ACE certificate. It was clear that there was eagerness for studying further in mathematics by educators because 25% of them, meaning 11 out of 44 educators, had a Bachelor Degree in Education and 23%, that is 10 educators out of 44, were in possession of an Honours degree in Education. Seven percent which is 3 out of 44 educators upgraded their qualifications and obtained a Master's degree.

The above analysis is a clear indication that mathematics educators acquired mathematical knowledge, skills and instructional strategies. Occupational rank of educators will be analysed on the next page.

- **Occupational rank of educators**

  The participants had different work status as indicated in the table below.

Table 4.5 Occupational Rank of Educators

Occupational Rank	**Frequency**	**Percent**
Principal	1	2
Deputy Principal	0	0
HOD	7	16
Educator (PL 1)	36	82
Total	**44**	**100**

The above table indicates that the majority of mathematics educators were Post Level one (PL 1) educators. Thirty-six out of 44 educators, which is 82%, were at the first level of the educators' occupational rank. This analysis emphasises the impact that PL 1 educators had in the connection of mathematics to everyday life. Sixteen percent which is 7 out of 44 educators were HODs and 2%, which is 1 out of 44, was a site manager. The deputy principals' position was not occupied by any of the 44 educators.

- **Duration of educators in their posts**

Fifty-seven percent of the educators had a period of six years and above teaching mathematics. The higher the percentage, the more experienced educators were. This results in the smooth running of the teaching and learning process, thus displaying an ability to make connections between mathematics and everyday life.

Figure 4.1 on the next page displays the duration of educators in their posts.

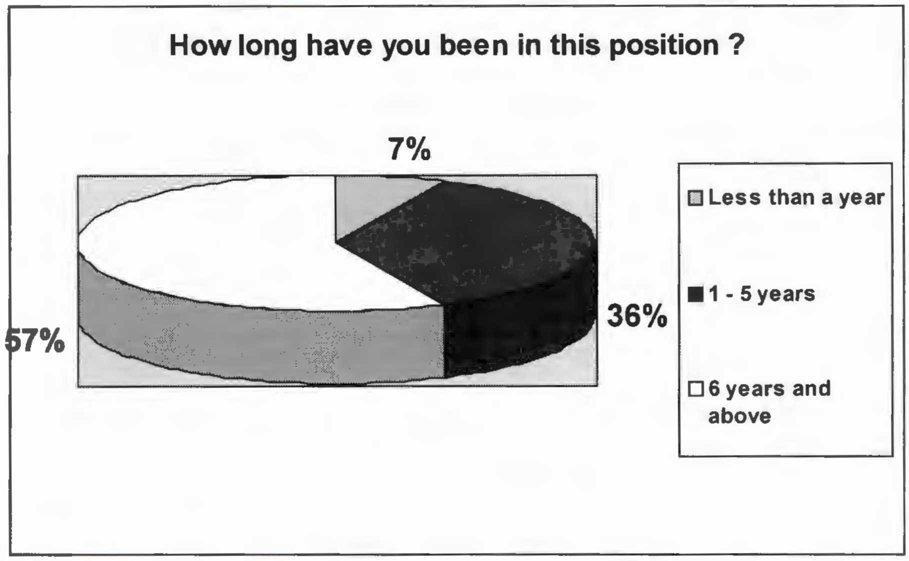


Figure 4.1: The duration of educators in their posts.

- **Teaching experience of educators**

  The teaching experience of mathematics educators is outlined in the table below.

Table 4.6 Teaching Experience of Educators

Teaching Experience (yrs)	Frequency	Percent
1 - 5	10	23
6 - 10	11	25
11 – 15	10	23
16 – 20	6	13
Over 20	7	16
Total	**44**	**100**

The above table shows the educators' teaching experience. Most of the mathematics educators had teaching experience of six to ten years. The number of newly appointed educators was the same as those who had eleven to fifteen years experience. Seven educators out of 44 were old hands in the teaching of mathematics, that is, 16% of the educators had over 20 years teaching experience thus implying that they had a lot of experience in teaching mathematics.

- **School Location**

Based on table 4.7 below, it is clear that the educators in this research were working in urban areas where most of the schools were technologically advanced and were equipped with resources. They were also at an advantage of being near the APO meaning that they might consult their subject advisors whenever they encountered difficulties in their teaching process.

Table 4.7 School Location

Location of School	Frequency	Percent
Rural	16	36
Urban	28	64
Total	**44**	**100**

- **School Background**

Table 4.8 below indicates the number of mathematics educators, periods, the duration of periods and whether schools had resources or not.

Table 4.8 School Background

Item No.	Statements	Response
9.1	The number of mathematics educators is : Less than 5 5 or more	41% 59%
9.2	The number of mathematics periods for every class per week/cycle is: Less than 7 7 or more	32% 68%
9.3	The duration(minutes) of one mathematics period is: Less than 40mins 40mins or more	23% 77%
9.4	Does the school have resources for mathematics lessons?	(82%) Yes (18%) No

The positive part about statement 9.1 was that at least every school had mathematics educators who were professionally qualified. Statement 9.3 indicated that mathematics periods had a duration of 40 minutes or more. Statement 9.2 indicated that mathematics was taught and learnt on a daily basis every week because the table shows that 68% of the educators had 7 or more mathematics periods per cycle. Statement 9.4 indicated that 82% of the schools had resources for mathematics lessons.

THE APPLICATION OF MATHEMATICS TO EVERYDAY LIFE

The table below displays the educators' responses on the structure of mathematics.

Table 4.9 The Structure of Mathematics

Item No.	Statements (The Structure of Mathematics)	SA (%)	A (%)	D (%)	SD (%)
1	Mathematics consists of a body of knowledge whose truths should be questioned.	23	48	13	16
2	Rules are the basic building blocks of all mathematical knowledge.	45	48	5	2
3	Mathematics is about knowing when to use rules and formulas to find answers to problems.	57	39	4	0
4	Mathematics is culture free.	32	34	20	14
5	School mathematics is made up of abstract concepts and ideas which are value free	14	32	29	25
6	Mathematics is about learning arithmetic, algebra and geometry.	25	46	18	11
7	Mathematics games indicate the connection of mathematics to everyday life	52	48	0	0
	TOTAL	**248**	**295**	**89**	**68**
	AVERAGE	**35.4**	**42.1**	**12.7**	**9.7**

SA = Strongly Agree; A=Agree; D=Disagree; SD=Strongly Disagree

Table 4.9 above indicates that most of the educators were positive when responding to statements about the structure of mathematics. Some educators disagreed and others strongly disagreed to statements about the structure of mathematics. This might have been caused by the teachers' attitude towards mathematics which might arise from lack of resources which was experienced by 18% of educators as stated in table 4.8.

- **Mathematics Teaching**

  The table below shows how educators responded to the statements which were based on the teaching of mathematics.

Table 4.10 Educators' responses towards the Teaching of Mathematics.

Item No.	Statements (Mathematics Teaching)	SA %	A %	D %	SD %
8	When teaching mathematics teachers should take into account students' prior knowledge learnt out of school.	64	34	2	0
9	The only mathematics students learn is that taught to them by teachers in schools.	9	9	50	32
10	In schools, teachers should teach only the mathematics that is prescribed in the syllabus and textbooks.	2	11	46	41
11	Mathematical knowledge is found only in mathematics textbooks.	2	5	45	48
12	Students come to school to learn "school mathematics" not cultural mathematics.	7	18	45	30
13	Mathematics identified in traditional cultural activities should also be taught in schools.	20	68	7	5
14	Mathematics practical activities are not as important as the "real mathematics" that is learnt in schools.	5	9	36	50
15	Mathematical knowledge can be learnt by taking part in traditional cultural activities such as fishing, building traditional houses.	16	70	9	5
16	It is possible to apply school mathematics to real life situations.	55	45	0	0
17	Mathematics identified in traditional cultural activities is useful to our modern society.	34	64	2	0
18	Traditional practices such as counting, measuring, drawing are also mathematical.	64	36	0	0
19	School mathematics should teach students about values in life.	43	55	2	0
	TOTAL	**321**	**424**	**244**	**211**
	AVERAGE	**26.8**	**35.3**	**20.3**	**17.6**

SA = Strongly Agree; A=Agree; D=Disagree; SD=Strongly Disagree

Most educators strongly agreed and agreed with statement number 8, 13, 15 to 19. Only a few educators disagreed and strongly disagreed with these statements. This indicated that some educators needed more information on the teaching of mathematics. Statements 9 to 12 and 14, were designed in a way that if educators responded by agreeing or strongly agreeing to these statements, then they were to be regarded as out-dated (not following the NCS style of teaching) when it came to the teaching of mathematics. The teaching of mathematics plays a very important role when it came to the connection of mathematics to everyday life activities. It is important to note that for one to be able to connect mathematics to everyday life, one should be equipped with the relevant knowledge, skills, values and attitudes.

Table 4.11 below displays the results of the educators' responses on the teachers' roles.

Table 4.11 The Teachers' Roles

Item No.	**Statements (Teachers' Roles)**	**SA %**	**A %**	**D %**	**SD %**
20	Teachers should take into account students' prior knowledge learnt out of school.	59	39	2	0
21	Teachers should demonstrate that the application of mathematics suits the primary, secondary and high schools.	52	48	0	0
22	Teachers should teach and demonstrate how school mathematics is used in the following:				
22.1	Cultural contexts.	34	64	2	0
22.2	Social context.	36	64	0	0
	TOTAL	**181**	**215**	**4**	**0**
	AVERAGE	**45.25**	**53.75**	**1**	**0**

SA = Strongly Agree; A=Agree; D=Disagree; SD=Strongly Disagree

The teacher plays a very important role in the learning process of learners. The above responses indicated that mathematics educators may be striving to instill knowledge, skills, values and attitudes during their mathematics lessons. The table indicates that 99% of educators know their roles as mathematics teachers.

- **Everyday Life Activities**

  The daily activities in which mathematics is integrated are listed together with the educators' responses in the table below. Through these activities, the researcher was able to compile a report concerning the teachers' perceptions in making connections between mathematics and everyday life experiences.

Table 4.12: Everyday Life Activities which are related to mathematics

Item No.	**Activity**	**No Maths (%)**	**Some Maths (%)**	**A Lot of Maths (%)**
1	A pilot flying an aeroplane.	9	9	82
2	A carpenter building a house.	2	5	93
3	Estimating the height of a tree.	2	30	68
4	Measuring the height of a student.	2	41	57
5	Selling packets of peanuts.	2	43	55
6	The teacher counting the number of students in the classroom.	5	52	43
7	Children playing a traditional game.	7	75	18
8	Making patterns on the walls.	2	43	55
9	Woman weaving a mat.	2	64	34
10	Painting a paved area.	7	45	48
11	Villagers building a traditional house.	2	43	55
12	Villager using the stars to navigate by canoe from one island to another.	4	39	57
13	Monthly budget.	2	23	75
14	The warrior counting his arrows using own counting system.	2	48	50
15	Building a canoe.	2	36	62
16	Shopping.	2	43	55
17	Baking.	2	48	50
18	Cooking.	5	59	36
19	Voting system.	2	36	62
20	Interpreting graphs.	2	9	89
	TOTAL	**65**	**791**	**1144**
	AVERAGE	**3.25**	**39.55**	**57.2**

Most of our everyday life activities have mathematics. The connection of mathematics to everyday life is experienced mainly in our daily life activities. Most of the educators responded positively by saying that our daily activities had a lot of mathematics in them.

4.3 INFERENTIAL DATA ANALYSIS

Chi-square test of independence is outlined as follows:

4.3.1 Chi-Square Test of Independence

The test was used to investigate the teachers' perceptions about relating mathematics to everyday life experiences. This test of independence was concerned with the relationship between two different factors (or categories) in a population under study.

Table 4.13: Test of Independence on perceptions of educators about mathematics

Hypotheses:

H_0: Row and column categories are independent (i.e. no relationship)

H_1: Row and column categories are not independent (i.e. relationship exists)

Significance level : 5% (i.e. 0,05)

Chi-square statistic = sum[$(o - e)^2$ /e] , o=observed, e=expected frequency

Degrees of freedom (df) = (r - 1)(c – 1), r = rows, c = columns

Rejection region : p-value (i.e. probability value) $\leq$ 5%

- **Perceptions of educators about mathematics**

  Educators had different perceptions about relating mathematics to everyday life. The table on the next page indicates the educators' responses to whether mathematics games may be connected to everyday life or not.

Table 4.14 : Perceptions of educators about mathematics

	Mathematics games indicate the connection of mathematics to everyday life.		
Location of School	**Strongly Agree**	**Agree**	**Total**
Rural	12	4	16
Urban	11	17	28
Total	23	21	44

p - value = 0,023   chi-square statistic = 5,206   df = 1

The SPSS 16.0 software package was used to perform a Chi-square test for the data in table 4.14. The chi-square statistic and the p-value with one degree of freedom were 5,206 and 0,023, respectively. Since the p-value was less than 5% level of significance, then the perception of educators about mathematics was significantly dependent on the location of the school. It means that the majority (17/28 = 61%) of the urban educators agreed that mathematics games indicated the connection of mathematics to everyday life, whereas the majority (12/16 = 75%) of the educators from the rural schools strongly agreed.

Table 4.15: Spearman's rank correlation between teaching experiences and perceptions of educators about mathematics.

Item		**Teaching Experience**
10.1 Mathematics consists of a body of knowledge whose truths should be questioned.	**Correlation coefficient (r)**	0,309
	p - value	0,041
10.2 Rules are the basic building blocks of all mathematical knowledge.	**Correlation coefficient (r)**	0,439
	p - value	0,003
10.3 Mathematics is about knowing when to use rules and formulas to find answers to problems.	**Correlation coefficient (r)**	0,486
	p - value	0,001

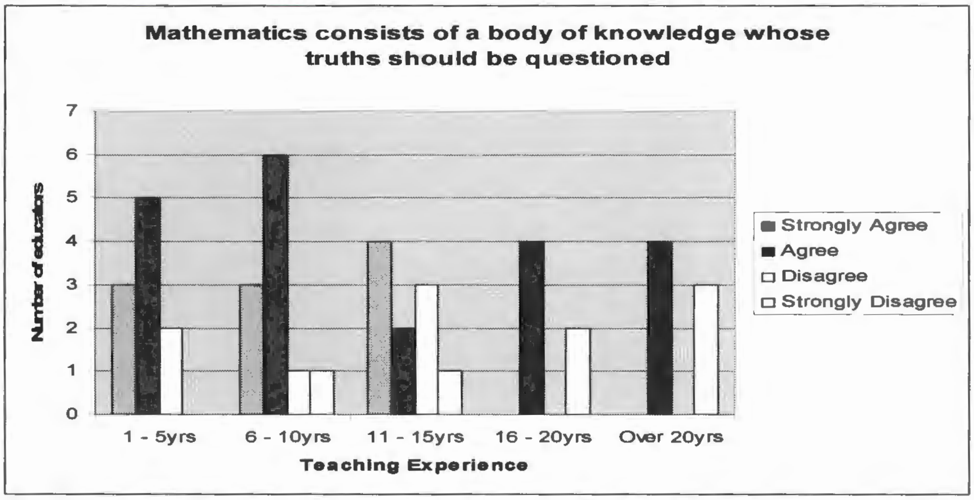
The SPSS 16.0 software package was used to perform the correlation analysis and the results are shown in Table 4.15. Since the p-values (0,041, 0.003 and 0,001) are less than 0,05 level of significance, then correlation between teaching experience and perceptions of educators on the three items is significant. The items are:

- Mathematics consists of a body of knowledge whose truths should be questioned.
- Rules are the basic building blocks of all mathematical knowledge.
- Mathematics is about knowing when to use rules and formulas to find answers to problems.

It means that:

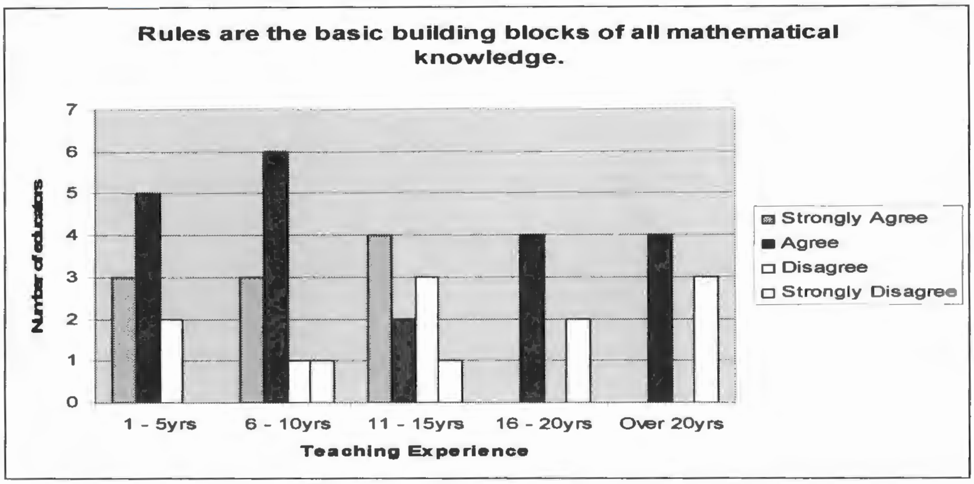
- less experienced educators agree that mathematics consist of a body of knowledge whose truths should be questioned whereas more experienced educators slightly disagree. See Figure 4.2 below:

Figure 4.2: Mathematics consist of a body of knowledge whose truths should be questioned.



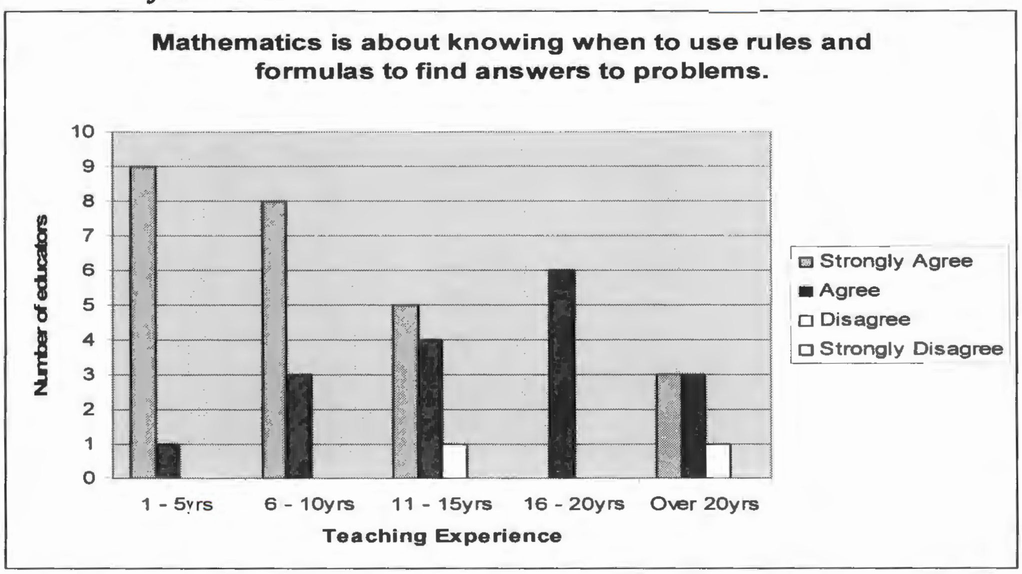
The probability of the likelihood ratio is less than the 0,05 significance level thus implying that 'mathematics consists of a body of knowledge whose truths should be questioned' is a statistically significant predictor of perceptions of educators about mathematics. Less experienced educators agree that rules are the basic building blocks of all mathematical knowledge, whereas more experienced educators slightly disagree. Figure 4.3 on the next page displays this.

Figure 4.3: Rules are the basic building blocks of all mathematical knowledge.



Less experienced educators strongly agree that mathematics was about knowing when to use rules and formulas to find answers to problems, whereas more experienced educators slightly agree. The probability value of 'rules are the basic building blocks of all mathematical knowledge' is less than the 0,05 level of significance therefore the statements about rules are statistically significant predictors of perceptions of educators about mathematics. See Figure 4.4 below:

Figure 4.4: Mathematics is about knowing when to use rules and formulas to find answers



4.4 ANALYSIS OF OPEN – ENDED RESPONSES

The constituents of open-ended questions were challenges and suggestions. Educators were allowed to write as much as they could on the challenges that they encountered in their teaching of mathematics, and suggestions as to how to improve the situation.

The following are challenges listed by the educators:

- Lack of dedicated teachers – teachers do not work extra time in order to assist in uplifting the level of mathematics understanding in their schools.
- Medium of instruction – educators should use the recommended medium of instruction. Code-switching could be done for the better understanding of learners.
- Home background – educators come from different home backgrounds which could hamper the smooth running of the teaching process.
- Classes too big – the educator – learner ratio in schools was unacceptable. Educators had to teach over-crowded classes.
- Time – extra time was needed in order to update educators' portfolios and to drill slow learners.
- Lack of resources – resources like text books and educators' guides were not available.
- Ignorance – it is the educators' duty to impart knowledge in a way that the importance of mathematics was recognised.

The following are suggestions to the above-mentioned challenges:

- Professionally trained educators should teach mathematics. This will result in good delivery of the subject matter, a better understanding of concepts and an ability to connect mathematics to everyday life.

- In-service training and workshops should be conducted in order to empower educators and improve the standard of mathematics teaching and learning.

- The use of the medium of instruction should be encouraged. Code-switching should be minimised. Teachers and learners should be able to interpret and analyse questions and instructions.

English is an official language that is used in text books and examination question papers, so it is advisable for mathematics educators to use the language of English in the teaching and learning process.

- The teacher-learner ratio should be taken into consideration. A large number of learners make it difficult for educators to reach all learners thus causing the connections of mathematics to everyday life to be less successful.

- Enough time should be allocated for mathematics periods and resources be provided in order to bridge gaps between school mathematics and out of school mathematics. Learners should be shown the importance of mathematics in order to cap the feeling of ignorance and regarding mathematics as a difficult learning area.

4.5 ANALYSIS OF RESEARCH QUESTIONS

The following sub-topics are an analysis of research questions based on the findings:

4.5.1 What do we mean when we talk about connections between mathematics and everyday life?

Table 4.12 displayed everyday life activities whereas table 4.14 displayed the perceptions of educators about mathematics. The results from the two tables indicated that between 18% to 93% of the educators understood the meaning of the connections between mathematics and everyday life. The responses of the educators concerning their perceptions about mathematics was 100% positive in a sense that 23 educators strongly agreed and 21 agreed with the statement "mathematics games indicate the connection of mathematics to everyday life". In table 4.12, 2% to 9% educators marked some activities as having no mathematics. This gives rise to a need for in-service training and workshops because all the activities that are listed in table 4.12 are connected to mathematics.

4.5.2 How do teachers connect mathematics to everyday life?

Classroom observations and table 4.12 indicated the teachers' perceptions in relating mathematics to everyday life.

The observation of the lessons whereby OBE was implemented (see Appendix G3), displayed the connections of mathematics to everyday life. The daily activities in table 4.12 are an indication of the teachers' perceptions in making connections between mathematics and everyday life experiences.

4.5.3 What challenges do teachers face when they apply mathematics knowledge to everyday lives?

This was an open-ended question on 'challenges'. The responses indicated that educators were faced with challenges when applying mathematics to everyday life. These challenges hampered the teaching and learning process which gave rise to misunderstanding of concepts thus causing disturbance in the connection of mathematics to everyday life to be a failure.

4.6 ANALYSIS OF INTERVIEWS

Interviews were conducted and the following are analysis of the educators' responses. The interview transcripts are in Appendix F3 of this study.

- How long have you been teaching in the school? Educators had different teaching experiences ranging from 4 and 26 years.
- How is the behaviour of learners? The learners' behaviour was fair, good and it also depended on how the teachers conduct himself during the lessons (see responses in Appendix F3).
- Which grade(s) are you teaching? The grades 4 to 7 were for the intermediate phase, 7 to 9 senior phase and grades 10 to 12 were for the FET level. The interviewed educators taught grades 7 to 12.
- What is the medium of instruction? All schools were using English as a medium of instruction.
- How often do you give learners home work? Educators gave learners work on a daily basis.
- How often do you give learners practical work? Educators gave learners practical work once per term.

- What is Mathematics? Educators defined mathematics in different ways as indicated in the interview transcripts. Educators responded by saying that mathematics is broad, have many sub-topics, not easy to define and it is a mother of all subjects. (see Appendix F3 for the interview scripts).
- Do you rely only on text books when teaching mathematics? Educators used other resources like charts and 3-dimensional models apart from the text books (see Appendix F3).
- What can you say about mathematical knowledge? Most educators understood what mathematical knowledge was. Teacher B responded by saying that it is used in and out of the classroom. (see Appendix F3 for the educators' responses on mathematical knowledge).
- What can you say about Games which involve mathematics? Educators were of an opinion that mathematical games were good for learners.
- Do you believe that mathematics is found only in schools? Educators voiced a view that mathematics was found everywhere.
- Are traditional practices linked to mathematics? Educators were positive that traditional practices were linked to mathematics.
- What is your role as a mathematics teacher? Responses were received from all the educators concerning their roles as mathematics teachers. Teacher C responded by saying that children are struggling so he must show them how enjoyable mathematics is and that it can be linked to everyday life. (see Appendix F3).
- Kindly give an example whereby mathematics is applied or connected to everyday life. Educators gave different examples like the theorem of Pythagoras used in buildings. See Appendix F3 for actual responses from educators.

4.7 ANALYSIS OF OBSERVATIONS

Observations were done and the following are an analysis based on what the researcher saw during classroom observations. Reflections on classroom observations are in Appendix G3 of this study.

- Is the classroom well arranged? Classrooms were conducive for teaching and learning process.

- Is the teacher using the OBE style of teaching? All educators (100%) were using the OBE style of teaching.
- Is the teacher using other resources apart from the text book? Chalkboard and most of the classrooms had mathematics charts on the wall.
- How often does the teacher involve learners in the lesson? Throughout the lesson.
- How often does the teacher assess learners? Throughout the lesson.
- Does the teacher allow learners to ask questions? Educators gave learners a chance to ask questions. Learners asked questions whenever they were in need of clarification.
- Can the teacher link the lesson to everyday life? Educators demonstrated the connection of mathematics to everyday life based on the lesson presented. Teacher A used an example of buildings in which angles could be used.
- Can the teacher demonstrate the connections of mathematics to everyday life? Educators demonstrated the connection of mathematics to everyday life. The demonstrations were different because of different contents of the lessons. Example: Trigonometry could be used by architects and civil engineers and again Pythagoras used the theory in gardens: $(hyp)^2 = (adj)^2 + (opp)^2$.

The learners' answers were used to demonstrate the connection of mathematics to everyday life. Example; in Appendix G5, the educator mentioned that angles are everywhere and learners looked around the classroom and smiled. The educator also explained to learners that the knowledge of angles can be used in roofing, carpentry.

4.8 SYNTHESIS

The collected data were analysed qualitatively and quantitatively. Qualitative analysis was done through descriptive analysis while mathematical and statistical techniques were used for quantitative analysis. Analysis of data was done under the headings of demographic data, school background and the applications of mathematics to everyday life. Discussions, conclusions and recommendations on the teachers' perceptions in making connections between mathematics and everyday life are outlined in the next chapter.

CHAPTER 5

DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

5.1 INTRODUCTION

The findings of the study concerning the teachers' perceptions in making connections between mathematics and everyday life experiences are discussed in this chapter. The challenges which educators faced in the teaching and learning process are also outlined. Suggestions on avoiding the barriers in the teaching and learning of mathematics, including the connections of mathematics to everyday life are made. Evaluation of the research, its contributions and recommendations are also made. A way forward which was identified from the analysis, has been considered for further investigations.

5.2 DISCUSSIONS OF FINDINGS

Discussions of findings of research questions and the analysed data are highlighted below.

5.2.1 Research Questions

Findings to research questions are analysed in the following paragraphs.

Research Question 1: What do we mean when we talk about connections between mathematics and everyday life?

Connections between mathematics and everyday life may be experienced in and out of the classroom. Below are the findings that are based on the above question.

Finding 1: The observations indicated that educators linked mathematics knowledge to everyday life experiences and that they were also positive that traditional practices were also linked to mathematics, but they did not demonstrate how these traditional practices were linked to mathematics in their lessons. The demonstrations on mathematics knowledge to everyday life were different because of different contents of the lessons.

Finding 2: The educators' verbal responses indicated that they really understood what connections between mathematics and everyday life meant but practically, not enough demonstrations were done.

Finding 3: Not all educators strongly agreed to the statement that "mathematics games indicate the connection of mathematics to everyday life". Some educators were doubtful about games being connected to mathematics. Some educators marked some activities as having no mathematics at all (see table 4.12).

Research Question 2: How do teachers connect mathematics to everyday life?
The connections of mathematics to everyday life are seen in practical activities like mathematical games in which learners play and learn to count and patterns simultaneously. The findings to this question are outlined below.

Finding 1: The teachers' verbal responses indicated that they gave the learners practical work only once per term. It was through practical work that the connections of mathematics to everyday life were well displayed. One practical work may not be sufficient to demonstrate the connections of mathematics to everyday life. Educators used other resources like charts and 3-dimensional models apart from the text books. Some educators experienced lack of resources, hence the connections of mathematics to everyday life were hampered.

Finding 2: Written tasks like home work were given to learners. The solutions involved the use of the theorem of Pythagoras and different sizes of angles. The learners' answers were used to demonstrate the connection of mathematics to everyday life. The educator explained to learners that the knowledge of angles could be used in roofing and carpentry.

Research Question 3: What challenges do teachers face when they apply mathematics knowledge to everyday lives?

The educators were faced with challenges when connecting mathematics to everyday life. These challenges hampered the teaching and learning process which gave rise to misunderstanding of concepts thus making it difficult for educators to demonstrate the connection of mathematics to everyday life. The findings are outlined below.

Finding 1: The medium of instruction hampered the smooth running of the teaching and learning process. Over-crowded classes were a barrier in demonstrating the connection of mathematics to everyday life.

Finding 2: Educators came from different home backgrounds which could hamper the smooth running of the teaching process. It is the educators' duty to impart knowledge in a way that the importance of mathematics was recognised.

Finding 3: Educators experienced lack of resources and more time was needed in order to give slow learners special attention.

Research Question 4: What may be done to help educators to be able to make connections between mathematics and everyday life?

The findings showed that educators suggested that mathematics teachers should be qualified. This would make it easy for them to show competency in their teaching profession.

5.2.2 Perceptions based on location of schools.

Sixty-four percent of the participating schools were situated in an urban area as indicated in table 4.7. This indicated that educators and learners were exposed to electronic resources which were of help to the teaching and learning of mathematics, thus making it easier for teachers to be able to demonstrate the connections of mathematics to everyday life. These schools were near to the APO. This was an advantage to educators because they consulted their subject advisors anytime they encountered problems or they were visited by the subject advisors to check if they were on the right track.

The researcher was able to verify the location of schools through the distribution of the questionnaire, attending classroom observations and conducting interviews. The triangulation was successful and was used to validate the gathered information.

5.2.3 Perceptions based on OBE

It was indicated by the researcher in chapter 2 that Bill Spady, an American Educationalist, became highly influential in curriculum planning and development in South Africa after 1994. The teaching experience of the participants ranged from 4 years to 21 years. This indicated that all participants were exposed to Outcomes Based Education because it was introduced to the South African system of education in 1994. Table 4.6 on page 62 verified the above-mentioned statement about the teaching experience of educators. The teaching experience of all the participants was highlighted in the questionnaire under the demographic data section. The researcher got the teaching experience information through the answers given during interviews and the teaching styles of educators during classroom observations indicated whether educators were constructivist or not.

Table 4.3 on page 59 displayed the fact that 100% of the educators who participated in the study were professionally qualified mathematics teachers. This was validated through questionnaires (questions 3 and 4 of the demographic data section). The interviews were an advantage to the researcher because the answers that were given were based on the knowledge of mathematics in general, indicated whether the educators were professionally qualified or not. The way lessons were delivered served as a guide to the researcher to determine whether the educators were professionally qualified for their jobs or not.

5.2.4 Teaching and Learning Support (Resources)

Table 4,8 on page 66 displayed information on whether the schools had resources or not. The figure shows that 82% of the participating schools had resources, thus making it easy for the educators to demonstrate the connections of mathematics to everyday life.

Question 7 in the interview schedule wanted information on practical work and question 9 wanted information on other resources apart from a text book. The responses to the two questions indicated that educators gave learners practical work once per term and all educators used other resources apart from the text book. Through observations, the researcher was able to note that text books and the chalkboard were the teaching and learning support materials that were mostly used by educators.

5.2.5 Lesson presentation and Teaching Strategies

Statements in part C of the questionnaire, under the structure of mathematics, mathematics teaching and the teachers' roles, were based on lesson presentations. The responses to these statements reflected that educators strongly agreed to the statements thus implying competency in lesson presentations and teaching strategies. Educators responded positively to the use of English as a medium of instruction and most of the educators displayed a knowledge of mathematics. To add to these, observations were an outstanding instrument for the researcher to identify the lesson presentation skill and the teaching strategies implemented by the educators.

The responses of part C of the questionnaire satisfied the answers given during the interviews and the two were enhanced by what the researcher's classroom observations (see appendix G3 of this study).

5.2.6 Assessment practice

Statement 10.16, "it is possible to apply school mathematics to real life situations" under mathematics teaching and statement 10.1 "mathematics consists of a body of knowledge whose truths should be questioned" were both based on assessment practice in the teaching and learning of mathematics. The responses showed that educators strongly agreed to the statements. This indicated that assessment practices might lead to a better way for teachers to demonstrate the connections of mathematics to everyday life. Question 6 in the interview schedule read, "how often do you give learners homework?" was based on the assessment of learners by educators.

Educators responded by saying that they gave learners homework on a daily basis. Statement 5 in the observation schedule read, "does the teacher assess learners?" was also based on assessment practices. In all observations that were conducted, all the educators assessed learners throughout the lesson.

5.2.7 Teacher support and development

Teacher support and development are needed because some of the educators did not understand what were the connections between mathematics and everyday life. The responses indicated that educators lacked understanding in the following aspects:
The structure of mathematics; The teaching of mathematics; The teachers' roles and The connections of mathematics to everyday life. There was an indication of misunderstanding of mathematical knowledge by educators. An educator responded by saying "What do you mean? Have a lot of maths knowledge" to question 10. This was rated as a poor response by the researcher (see the 1st interview transcript). Through observations, the researcher could see that there was lack of confidence in some of the educators by the way they behaved during the lessons. Teachers need to be supported and developed through workshops and in-service training. The three instruments used gave the same results. The connections of mathematics to everyday life cannot be displayed until these barriers are addressed.

5.2.8 Problems and Challenges

Problems and challenges encountered which are listed under the analysis of open-ended responses, indicated that connections of mathematics to everyday life cannot be executed unless these are dealt with accordingly.

5.3 RECOMMENDATIONS

The recommendations concerning the teachers' perceptions in making connections between mathematics and everyday life are listed in the next page:

Research Question 1: What do we mean when we talk about connections between mathematics and everyday life?

Connections between mathematics and everyday life may be experienced in and out of the classroom. Below are the recommendations that are based on the above question.

Recommendation 1: There is a need for in-service training and workshops. Educators should be in a position to demonstrate the connection of mathematics to everyday life in a way that they show learners the importance of mathematics in and out of school.

Recommendation 2: Apart from the learners' examples of mathematics connections to everyday life, educators should give examples like mathematics being linked to different careers.

Recommendation 3: Educators should be work-shopped and made aware of the fact that good performance in mathematics opens doors and bursary opportunities to different universities.

Research Question 2: How do teachers connect mathematics to everyday life?
The connections of mathematics to everyday life are seen in practical activities like mathematical games in which learners play and learn to count and design patterns simultaneously. The recommendations to this question are outlined below.

Recommendation 1: Educators as role models, should be enthusiastic during lesson presentations. More practical work should be done. The use of different strategies and improvisation are necessary if there is lack of resources. More examples that display the connection of mathematics to everyday life should be given in order to show learners that mathematics may be connected to almost everything.

Recommendation 2: Written tasks given to learners should be controlled in order to check if the teachers' demonstrations were understood or not. The teachers' positive interaction with learners is very important and it may result in a better demonstration of the connection of mathematics to everyday life.

Research Question 3: What challenges do teachers face when they apply mathematics knowledge to everyday lives?
The challenges encountered by educators hampered the teaching and learning process which gave rise to misunderstanding of concepts thus making it difficult for educators

to demonstrate the connection of mathematics to everyday life. The recommendations are outlined in the following paragraphs.

Recommendation 1: Educators should use the recommended medium of instruction. The use of the medium of instruction should be encouraged. Code-switching should be minimised. Teachers and learners should be able to interpret and analyse questions and instructions. English is an official language that is used in text books and examination question papers, so it is advisable for mathematics educators to use the language of English in the teaching and learning process. The educator – learner ratio in schools should be balanced. Professionally trained educators should teach mathematics. This will result in good delivery of the subject matter, a better understanding of concepts and an ability to connect mathematics to everyday life.

Recommendation 2: In-service training and workshops should be conducted in order to empower educators and improve the standard of mathematics teaching and learning. Teachers should improvise if they experience lack of resources.

Recommendation 3: Enough time should be allocated for mathematics periods and resources be provided in order to bridge gaps between school mathematics and out of school mathematics. Learners should be shown the importance of mathematics in order to cap the feeling of ignorance and regarding mathematics as a difficult learning area.

Research Question 4: What may be done to help educators to be able to make connections between mathematics and everyday life?

The recommendations to the above question are discussed below.

- **Professional Development**

The researcher believes that a professionally developed educator will automatically be enthusiastic, develop a love for mathematics and have the interest of the learners at heart. In-service training and workshops were needed in order to improve the educators' teaching strategies and knowledge of concepts. The challenges that teachers face when they apply mathematics knowledge to everyday lives should be given special attention by submitting them to the relevant offices.

- **In- Service Training and Workshops**

Teachers need to be work shopped and in-serviced. The Ministry of Education and Malawi Institute of Education, cited by Mwakapenda (2002: 261), pointed out that in-service training programmes should be intensified in order to update teachers with new knowledge, skills and innovations in their respective areas.

5.4 FUTURE RESEARCH

A study on the teachers' competence in relation to the different levels of the mathematics curriculum - intended, implemented, attained should be conducted. A large number of educators should be sampled and this should allow generalizations of the results. Educators should guide and motivate the learners in a way that they are always there for them whenever they need assistance. More time should be spent practicing mathematics. Mathematics is needed for job opportunities.

5.5 CONCLUSION

The research intended to investigate how teachers made connections between mathematics and everyday life experiences. As highlighted in chapter four, table 4.9, on the average 78% of educators have an understanding of the structure of mathematics with item 3 having the highest percentage 96%. Furthermore, educators have shown to agree on the teaching of mathematics with an average of 62% of educators agreeing on aspects that need to be taken into consideration when teaching mathematics (see table 4.10). Educators have also demonstrated their understanding of their roles as indicated in table 4.11. Ninety-nine percent of educators have shown to know what their roles were.

The findings of this study implied that the connection of mathematics to everyday life experiences was done on a daily basis but some educators were not aware of that. It indicated that educators made connections between mathematics and everyday life experiences in their lessons. It is the teachers' task to make learners aware of the fact that mathematics is applied everyday in the daily activities at home, schools and work places. Ability to demonstrate to learners that there was a link between mathematics lessons and everyday life activities was influenced by background experiences of a teacher.

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APPENDIX A

The APO Manager

Name of School

Sir / Madam

REQUEST FOR PERMISSION TO CONDUCT A RESEARCH STUDY

This letter serves as a request to conduct a research titled: "Exploration of teachers' perceptions in making connections between mathematics and everyday life experiences" under the supervision of Prof Thapelo Mamiala. The research will involve Mathematics teachers as the main participants. The purpose of the research is to explore how teachers incorporate and make connections of everyday experiences in their teaching of Mathermatics.

I am a part time Masters Degree student in Mathematics/Science Education at North West University (Mafikeng Campus), South Africa. Mathematics is integrated in all learning areas and it is needed in almost all careers. It is the teachers' responsibility to ensure that they turn Mathematics into an interesting learning area by demonstrating to learners the importance of Mathematics as well as how it may be applied in real life situations. I believe that the research may provide teachers with insightful understanding on how to connect everyday experiences when teaching Mathematics.

Confidentiality will be exercised throughout the data collection process and the collected information will only be used for the purpose of the research study. No reference will be made to the school or the teachers that will participate in the study, pseudonyms will be used.

Thank you in advance for your cooperation.

Yours faithfully

....

PATRICIA MAKGOPELA
CELL: 076 349 0775

APPENDIX B

education

Lefapha la Thuto
Onderwys Departement
Department of Education
NORTH WEST PROVINCE

Cnr. Thelesho Tawana & Modiri Molema
Private Bag x 10
Mmabatho 2735
Tel.: +27 (18) 384-3233
Fax: +27 (18) 384-0212/3234
E-mail:
blekoma@nwpg.gov.za

MAFIKENG AREA PROJECT OFFICE

Enquiries : N.M.Kokong

Date : 07 September 2009

To Whom it may concern

Premission to conduct a reseach titled "**Exploration of teachers**" ability to make connections between Mathematics and everyday life is hereby granted.

You are also permitted to interact with schools and edcators without tempering with teaching time

We wish you well in your studies

....
N.M. Kokong
MAFIKENG APO MANAGER

DEPARTMENT OF EDUCATION
MAFIKENG A.P.O.
2009 -09- 07
Private Bag X2047
Mmabatho
2735

APPENDIX C

The Principal

Name of School

Sir / Madam

REQUEST FOR PERMISSION TO CONDUCT A RESEARCH STUDY

This letter serves as a request to conduct a research titled: "Exploration of teachers' perceptions in making connections between mathematics and everyday life experiences" under the supervision of Prof Thapelo Mamiala. The research will involve Mathematics teachers as the main participants. The purpose of the research is to explore how teachers incorporate and make connections of everyday experiences in their teaching of Mathermatics.

I am a part time Masters Degree student in Mathematics/Science Education at North West University (Mafikeng Campus), South Africa. Mathematics is integrated in all learning areas and it is needed in almost all careers. It is the teachers' responsibility to ensure that they turn Mathematics into an interesting learning area by demonstrating to learners the importance of Mathematics as well as how it may be applied in real life situations. I believe that the research may provide teachers with insightful understanding on how to connect everyday experiences when teaching Mathematics.

Confidentiality will be exercised throughout the data collection process and the collected information will only be used for the purpose of the research study. No reference will be made to the school or the teachers that will participate in the study, pseudonyms will be used.

Thank you in advance for your cooperation.

Yours faithfully

....

PATRICIA MAKGOPELA
CELL: 076 349 0775

APPENDIX D

CONSENT FOR PARTICIPANTS

I .... (full names of the educator) agree to participate willingly in the research. I agree that the aim and purpose of the study were explained to me fully. I also understand that the task that I will perform will not form part of my performance appraisal as a mathematics educator. I was informed by the researcher that my real name will not be used in the research report.

....

Signature of the Educator **Date signed**

APPENDIX E

QUESTIONNAIRE FOR EDUCATORS

TOPIC: Exploring the teachers' perceptions in making connections between mathematics and everyday life experiences.

PART A

DEMOGRAPHIC DATA

The following information is necessary for research purposes. Please answer the questions as accurately as possible. Your co-operation will be highly appreciated.
Note that there is no wrong or right answer and all the information gathered will be kept confidential.

Tick (√) the appropriate box.

1. Gender

1.1	Male	
1.2	Female	

2. Age Category (in years)

2.1	25 – 29	
2.2	30 – 39	
2.3	40 – 49	
2.4	50 - 59	
2.5	60 and above	

3. Profession

3.1	Professional teacher	
3.2	Not a professional teacher	

4. Qualifications

4.1	Diploma / Certificate in Education	
4.2	Advanced Certificate in Education	
4.3	Bachelor Degree in Education	
4.4	Bachelor Degree (Honours) in Education	
4.5	Masters Degree in Education	

5. **Occupational Rank**

5.1	Principal	
5.2	Deputy Principal	
5.3	Head of Department	
5.4	Educator	

6. **For how long have you been in this position?**

6.1	Less than a year	
6.2	1 – 5 years	
6.3	6 years and above	

7. **Teaching Experience**

7.1	1 – 5 years	
7.2	5 – 10 years	
7.3	10 – 15 years	
7.4	15 – 20 years	
7.5	20 – 25 years	

8. **Your school location**

8.1	Rural	
8.2	Urban	

PART B

9. **SCHOOL BACKGROUND**

Kindly respond to the following statements. Write your response in the response column.

	STATEMENTS	RESPONSE
9.1	The number of mathematics educators is	
9.2	The number of mathematics periods for every class per week/cycle is	
9.3	The duration of one mathematics period in minutes is	
9.4	Does the school have resources for Mathematics lessons?	

PART C

10. THE APPLICATION OF MATHEMATICS TO EVERYDAY LIFE
(Thompson, A. (1992).

Tick (√) the appropriate box.

SD - Strongly Agree A – Agree D – Disagree SD - Strongly Disagree

	STATEMENTS	S A	A	D	S D
10.1	**The Structure of mathematics:** Mathematics consists of a body of knowledge whose truths should be questioned.				
10.2	Rules are the basic building blocks of all mathematical knowledge.				
10.3	Mathematics is about knowing when to use rules and formulas to find answers to problems.				
10.4	Mathematics is culture free.				
10.5	School mathematics is made up of abstract concepts and ideas which are value free				
10.6	Mathematics is about learning arithmetic, algebra and geometry.				
10.7	Mathematics games indicate the connection of mathematics to everyday life.				
10.8	**Mathematics Teaching:** When teaching mathematics teachers should take into account students prior knowledge learnt <u>out</u> of school.				
10.9	The only mathematics students learn are those taught to them by teachers in schools.				
10.10	In schools, teachers should teach only the mathematics that is prescribed in the syllabus and textbooks.				

10.11	Mathematical knowledge is found only in mathematics textbooks.				
10.12	Students come to school to learn "school mathematics" not cultural mathematics.				
10.13	Mathematics identified in traditional cultural activities should also be taught in schools.				
10.14	Mathematics practical activities are not as important as the "real mathematics" that is learnt in schools.				
10.15	Mathematical knowledge can be learnt by taking part in traditional cultural activities such as fishing, building traditional houses.				
10.16	It is possible to apply school mathematics to real life situations.				
10.17	Mathematics identified in traditional cultural activities is useful to our modern society.				
10.18	Traditional practices such as counting, measuring, drawing are also mathematical.				
10.19	School mathematics should teach students about values in life.				
10.20	**The Teachers' Roles:** Teachers should take into account students prior knowledge learnt out of school.				
10.21	Teachers should demonstrate that the application of mathematics suits the primary, secondary and high schools.				
10.22	Teachers should teach and demonstrate how school mathematics is used in the following:				
10.23	Cultural contexts.				
10.24	Social context.				

PART D

EVERYDAY LIFE ACTIVITIES.

Tick (√) the appropriate box.

	ACTIVITIES	No Maths	Some Maths	A Lot of Maths
1.	A pilot flying an aeroplane.			
2.	A carpenter building a house.			
3.	Estimating the height of a tree.			
4.	Measuring the height of a student			
5.	Selling packets of peanuts.			
6.	The teacher counting the number of students in the classroom.			
7.	Children playing a traditional game.			
8.	Making patterns on the walls.			
9.	Woman weaving a mat.			
10.	Painting a paved area.			
11.	Villagers building a traditional house.			
12.	Villager using the stars to navigate by canoe from one island to another.			
13.	Monthly budget.			
14.	The warrior counting his arrows using own counting system.			
15.	Building a canoe.			
16.	Shopping.			
17.	Baking.			
18.	Cooking.			
19.	Voting system.			
20.	Interpreting graphs.			

PART E

CHALLENGES AND SUGGESTIONS

Write down the challenges that you experienced on the application of mathematics to everyday life and suggestions on how to deal with these challenges.

CHALLENGES:...

....

....

SUGGESTIONS:..

....

....

Thank You for your time and co-operation. May God Bless You!

APPENDIX F1

INTERVIEW SCHEDULE FOR MATHEMATICS EDUCATOR(S)

1. What is your name?
2. How long have you been teaching in this school?
3. How is the behaviour of learners?
4. Which grade(s) are you teaching?
5. What is the medium of instruction?
6. How often do you give learners home works?
7. How often do you give learners practical work?
8. What is Mathematics?
9. Do you rely only on text books when teaching Mathematics?
10. What can you say about Mathematical knowledge?
11. What can you say about Games which involve Mathematics?
12. Do you believe that Mathematics is found only in schools?
13. Are traditional practices linked to Mathematics?
14. What is your role as a Mathematics teacher?
15. Kindly give an example whereby Mathematics is applied or connected to everyday life.

APPENDIX F2

INTERVIEW SCHEDULE FORM WITH EDUCATORS' RESPONSES

(To be completed by the researcher)

Teacher number ....

	QUESTIONS	ANSWERS
1.	What is your name?	
2.	How long have you been teaching in this school?	
3.	How is the behaviour of learners?	
4.	Which grade(s) are you teaching?	
5.	What is the medium of instruction?	
6.	How often do you give learners home works?	
7.	How often do you give learners practical work?	
8.	What is Mathematics?	
9.	Do you rely only on text books when teaching mathematics?	
10.	What can you say about Mathematical knowledge?	
11.	What can you say about Games which involve mathematics?	
12.	Do you believe that Mathematics is found only in schools?	
13.	Are traditional practices linked to Mathematics?	
14.	What is your role as a mathematics teacher?	
15.	Kindly give an example whereby Mathematics is applied or connected to everyday life.	

APPENDIX F3

INTERVIEW TRANSCRIPTS

1st INTERVIEW

TRANSCRIPTS	COMMENTS
INTERVIEWER: Good morning sir. My name is Patricia Makgopela but you may call me Pat. I am from the North West University and am doing a research study on the teachers' perceptions in making connections between mathematics and everyday life experiences. I just need only a few minutes of your time to ask you questions concerning yourself as a mathematics teacher. What is your name, sir? **INTERVIEWEE:** My name is Teacher A	Good. A real name given.
INTERVIEWER: How long have you been teaching in this school? **INTERVIEWEE:** 4 years.	A true answer.
INTERVIEWER: How is the behaviour of learners? **INTERVIEWEE:** Average 6 out of 10.	Good.
INTERVIEWER: Which grade(s) are you teaching? **INTERVIEWEE:** Grade 10 to 12.	A true answer.
INTERVIEWER: What is the medium of instruction? **INTERVIEWEE:** English.	Good.
INTERVIEWER: How often do you give learners home works? **INTERVIEWEE:** Daily.	A positive response.
INTERVIEWER: How often do you give learners practical work? **INTERVIEWEE:** One in two weeks.	Good.
INTERVIEWER: What is mathematics? **INTERVIEWEE:** Maths is broad, have many sub-topics, not easy to define. It is a mother of all subjects.	A positive response.

INTERVIEWER: Do you rely only on text books when teaching mathematics? **INTERVIEWEE:** No. I do not use one source.	A positive answer.
INTERVIEWER: What can you say about mathematical knowledge? **INTERVIEWEE:** What do you mean? Have a lot of maths knowledge.	A poor response.
INTERVIEWER: What can you say about Games which involve mathematics **INTERVIEWEE:** I would prefer to have more maths games to improve skills. Maths should be fun.	Positive response
INTERVIEWER: Do you believe that mathematics is found only in schools? **INTERVIEWEE:** No. Everywhere.	A positive response.
INTERVIEWER: Are traditional practices linked to mathematics. **INTERVIEWEE:** Everything.	A positive response.
INTERVIEWER: What is your role as a mathematics teacher? **INTERVIEWEE:** Trying to educate the community at large. I give extra classes to learners from different schools.	Good.
INTERVIEWER: Kindly give an example whereby mathematics is applied or connected to everyday life. **INTERVIEWEE:** ^ Travelling to school – speed and time; ^ Building – measurement – length, breadth, ^ Height – approximating; ^ Financial maths – Loans – a person become financially responsible.	A positive response.
INTERVIEWER: Thank you for your time sir. **INTERVIEWEE:** You're welcome.	Good.

2nd INTERVIEW

TRANSCRIPTS	COMMENTS
INTERVIEWER: Good morning mam. My name is Patricia Makgopela but you may call me Pat. I am from the North West University and am doing a research study on the teachers' perceptions in making connections between mathematics and everyday life experiences. I just need only a few minutes of your time to ask you questions concerning yourself as a mathematics teacher. What is your name, sir? **INTERVIEWEE:** My name is Teacher B	A way of creating a relaxed atmosphere
INTERVIEWER: How long have you been teaching in this school? **INTERVIEWEE:** 4 years.	True response
INTERVIEWER: How is the behaviour of learners? **INTERVIEWEE:** Fair.	Good
INTERVIEWER: Which grade(s) are you teaching? **INTERVIEWEE:** 7 to 9.	True response
INTERVIEWER: What is the medium of instruction? **INTERVIEWEE:** English.	Positive response
INTERVIEWER: How often do you give learners home works? **INTERVIEWEE:** Every time when I have a class.	Good
INTERVIEWER: How often do you give learners practical work? **INTERVIEWEE:** Once per term.	Good
INTERVIEWER: What is mathematics? **INTERVIEWEE:** A measure of the universe. Everything is Numbers.	Positive response

INTERVIEWER: Do you rely only on text books when teaching mathematics? **INTERVIEWEE:** No.	Good
INTERVIEWER: What can you say about mathematical knowledge? **INTERVIEWEE:** It is used in almost everything in and out of the Classroom.	Positive response
INTERVIEWER: What can you say about Games which involve mathematics **INTERVIEWEE:** Games increase the knowledge of mathematics for learners.	Positive response
INTERVIEWER: Do you believe that mathematics is found only in schools? **INTERVIEWEE:** No.	Positive response
INTERVIEWER: Are traditional practices linked to mathematics? **INTERVIEWEE:** Yes. Traditional doctors are taught about measurement. Measurement start when cutting the umbilical cord.	Positive response
INTERVIEWER: What is your role as a mathematics teacher? **INTERVIEWEE:** To inform learners that everything is mathematics; (pause) careers, everything.	Positive response
INTERVIEWER: Kindly give an example whereby Mathematics is applied or connected to everyday life. **INTERVIEWEE:** Building, carpenter, and so on.	Good
INTERVIEWER: Thank you for your time, mam, ke a leboga. **INTERVIEWEE:** Go siame mam.	Good

3rd INTERVIEW

TRANSCRIPTS	COMMENTS
INTERVIEWER: Good morning sir. My name is Patricia Makgopela but you may call me Pat. I am from the North West University and am doing a research study on the teachers' perceptions in making connections between Mathematics and everyday life experiences. I just need only a few minutes of your time to ask you questions concerning yourself as a mathematics teacher. What is your name, sir? **INTERVIEWEE:** My name is Teacher C	Greetings ease the tension between the two parties.
INTERVIEWER: How long have you been teaching in this school? **INTERVIEWEE:** 26 years.	A true response
INTERVIEWER: How is the behaviour of learners? **INTERVIEWEE:** Good.	Good
INTERVIEWER: Which grade(s) are you teaching? **INTERVIEWEE:** Grade 11 and 12.	A true response
INTERVIEWER: What is the medium of instruction? **INTERVIEWEE:** English and Afrikaans.	Positive response
INTERVIEWER: How often do you give learners home works? **INTERVIEWEE:** Everyday.	Good
INTERVIEWER: How often do you give learners practical work? **INTERVIEWEE:** One per term	Good
INTERVIEWER: What is mathematics? **INTERVIEWEE:** About numbers, problem-solving, and so on.	Positive response

INTERVIEWER: Do you rely only on text books when teaching mathematics? **INTERVIEWEE:** Text books, experience and other resources.	Good
INTERVIEWER: What can you say about mathematical knowledge? **INTERVIEWEE:** Good for the development of the brain. Everywhere, every step we take is maths.	Positive response
INTERVIEWER: What can you say about Games which involve mathematics **INTERVIEWEE:** Good for learners and we should encourage learners to play these games. Keep the mind active. Plays an important role now than in the past (computers, etc.)	Positive response
INTERVIEWER: Do you believe that mathematics is found only in schools? **INTERVIEWEE:** No. It is all over.	Positive response
INTERVIEWER: Are traditional practices linked to mathematics? **INTERVIEWEE:** Yes. Mathematics is everywhere.	Positive response
INTERVIEWER: What is your role as a mathematics teacher? **INTERVIEWEE:** Because the children are struggling, I have to show them how enjoyable maths is and that it can be linked to everyday life.	Positive response
INTERVIEWER: Kindly give an example whereby mathematics is applied or connected to everyday life. **INTERVIEWEE:** The theorem of Pythagoras used in buildings.	Good
INTERVIEWER: Thank you for your time sir (shake his hands). **INTERVIEWEE:** The pleasure is mine (smiling).	Good

4th INTERVIEW

TRANSCRIPTS	COMMENTS
INTERVIEWER: Good morning sir. My name is Patricia Makgopela but you may call me Pat. I am from the North West University and am doing a research study on the teachers' perceptions in making connections between Mathematics and everyday life experiences. I just need only a few minutes of your time to ask you questions concerning yourself as a mathematics teacher. What is your name, sir? **INTERVIEWEE:** My name is Teacher D	Greetings create a relaxed atmosphere
INTERVIEWER: How long have you been teaching in this school? **INTERVIEWEE:** 18 years.	A true response
INTERVIEWER: How is the behaviour of learners? **INTERVIEWEE:** Depends on the teacher.	Positive answer
INTERVIEWER: Which grade(s) are you teaching? **INTERVIEWEE:** Grade 6 and 7.	A true response
INTERVIEWER: What is the medium of instruction? **INTERVIEWEE:** English.	Positive response
INTERVIEWER: How often do you give learners home works? **INTERVIEWEE:** Everyday. I follow the school policy. All the work that is not finished in class is done as homework.	Good
INTERVIEWER: How often do you give learners practical work? **INTERVIEWEE:** Once per term.	Good
INTERVIEWER: What is mathematics? **INTERVIEWEE:** A way of living. You cannot go without maths.	Positive response

INTERVIEWER: Do you rely only on text books when teaching mathematics? **INTERVIEWEE:** Compile work-sheets from different text books.	Good
INTERVIEWER: What can you say about mathematical knowledge? **INTERVIEWEE:** The knowledge part of maths is very important. Basics are important.	Positive response
INTERVIEWER: What can you say about Games which involve Mathematics **INTERVIEWEE:** Card game, monopoly – money game can be used to educate learners. It is a fun part of learning.	Positive response
INTERVIEWER: Do you believe that mathematics is found only in schools? **INTERVIEWEE:** No. All around us. You can't go without mathematics. Buying, budget, etc.	Positive response
INTERVIEWER: Are traditional practices linked to mathematics? **INTERVIEWEE:** I'm not clued up with that. Teachers need to be work-shopped.	A fair answer
INTERVIEWER: What is your role as a mathematics teacher? **INTERVIEWEE:** I regard maths teachers as very important. They must create a love for maths.	Positive response
INTERVIEWER: Kindly give an example whereby mathematics is applied or connected to everyday life. **INTERVIEWEE:** Angles, buying, budget.	Positive response
INTERVIEWER: Thank you for your time sir. **INTERVIEWEE:** Pleasure mam.	Good

5th INTERVIEW

TRANSCRIPTS	COMMENTS
INTERVIEWER: Good morning mam. My name is Patricia Makgopela but you may call me Pat. I am from the North West University and am doing a research study on the teachers' perceptions in making connections between Mathematics and everyday ife experiences. I just need only a few minutes of your time to ask you questions concerning yourself as a mathematics teacher. What is your name, mam? **INTERVIEWEE:** My name is Teacher E	A way of creating a relaxed atmosphere
INTERVIEWER: How long have you been teaching in this school? **INTERVIEWEE:** 7 years.	True response
INTERVIEWER: How is the behaviour of learners? **INTERVIEWEE:** Some are good others are rude.	Good
INTERVIEWER: Which grade(s) are you teaching? **INTERVIEWEE:** Grade 10 and 11.	True response
INTERVIEWER: What is the medium of instruction? **INTERVIEWEE:** English.	Positive response
INTERVIEWER: How often do you give learners home works? **INTERVIEWEE:** Everyday.	Good
INTERVIEWER: How often do you give learners practical work? **INTERVIEWEE:** Once per quarter.	Good

INTERVIEWER: What is mathematics? **INTERVIEWEE:** The study of geometry, algebra, etcetera.	Positive response
INTERVIEWER: Do you rely only on text books when teaching mathematics? **INTERVIEWEE:** No, general knowledge.	Good
INTERVIEWER: What can you say about mathematical knowledge? **INTERVIEWEE:** It can be used in different subjects.	Positive response
INTERVIEWER: What can you say about Games which involve mathematics **INTERVIEWEE:** They can be used to teach maths.	Positive response
INTERVIEWER: Do you believe that mathematics is found only in schools? **INTERVIEWEE:** No.	Positive response
INTERVIEWER: Are traditional practices linked to mathematics? **INTERVIEWEE:** Yes.	Good
INTERVIEWER: What is your role as a mathematics teacher? **INTERVIEWEE:** To develop the learners.	Positive response
INTERVIEWER: The last question mam, kindly give an example whereby mathematics is applied or connected to everyday life. **INTERVIEWEE:** Brick-laying, fixing doors, everything is mathematics.	Positive response
INTERVIEWER: Thank you for your time mam. **INTERVIEWEE:** Pleasure.	Good

APPENDIX G1

CLASSROOM OBSERVATION CRITERIA

The researcher will do observations based on the questions below. The researcher will then complete the observation form in appendix E.

- Is the classroom well arranged?
- Is the teacher using the OBE style of teaching?
- Is the teacher using other resources apart from the text book?
- How often does the teacher involve learners in the lesson?
- How often does the teacher assess learners?
- Does the teacher allow learners to ask questions?
- Can the teacher link the lesson to everyday life?
- Can the teacher demonstrate the connections of Mathematics to everyday life?

APPENDIX G2

CLASSROOM OBSERVATION FORM

DATE : ....

SCHOOL : ....

EDUCATOR : ....

SUBJECT : ....

TOPIC : ....

GRADE : ....

DURATION : ....

	STATEMENT	YES	N0	COMMENTS
1.	Is the classroom well arranged?			
2.	Is the teacher using the OBE style of teaching?			
3.	Is the teacher using other resources apart from the text book?			
4.	Does the teacher involve learners in the lesson?			
5.	Does the teacher assess learners?			
6.	Does the teacher allow learners to ask questions?			
7.	Can the teacher link the lesson to everyday life?			
8.	Can the teacher demonstrate the connections of Mathematics to everyday life?			

APPENDIX G3

REFLECTIONS ON CLASSROOM OBSERVATION 1

DATE : 30 July 2009

SCHOOL : A

EDUCATOR : A

SUBJECT : MATHEMATICS

TOPIC : CAST DIAGRAM (Cartesian Plane)

GRADE : 11

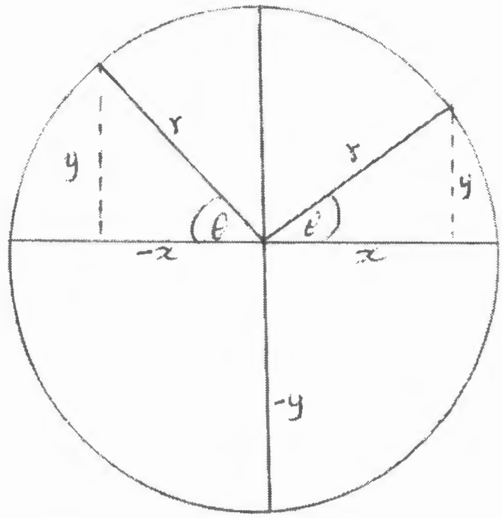
DURATION : 40 MINUTES (8h50 – 9h30)

	STATEMENT	YES	N0	COMMENTS
1.	Is the classroom well arranged?	√		Learners are seated in pairs facing the direction of the teacher.
2.	Is the teacher using the OBE style of teaching?	√		Question and answer method.
3.	Is the teacher using other resources apart from the text book?	√		Chalkboard
4.	Does the teacher involve learners in the lesson?	√		Ask learners questions, allow learners to explain their findings.
5.	Does the teacher assess learners?	√		Ask questions throughout the lesson.
6.	Does the teacher allow learners to ask questions?	√		asked questions whenever they were in need of the teacher's clarification.
7.	Can the teacher link the lesson to everyday life?	√		Buildings need angles and measurements.
8.	Can the teacher demonstrate the connections of Mathematics to everyday life?	√		Trigonometry can be used by architects and civil engineers. Pythagoras used the theory in gardens: $(hyp)^2 = (adj)^2 + (opp)^2$

Notes and classwork: see the attached documents on the next pages.

NOTES

CAST DIAGRAM



FIRST QUADRANT

$\sin\theta = \frac{y}{r}$

$\cos\theta = \frac{x}{r}$

$\tan\theta = \frac{y}{x}$

SECOND QUADRANT

$\sin\theta = \frac{y}{r}$

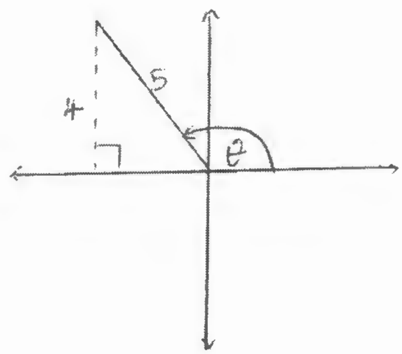
$\cos\theta = \frac{-x}{r}$

$\tan\theta = \frac{y}{-x}$

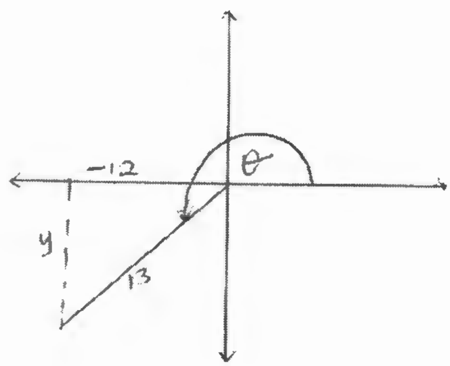
CLASSWORK

FIND THE VALUES OF x; y and r in the following diagrams.

①



②



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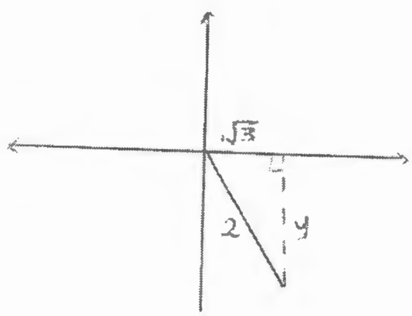
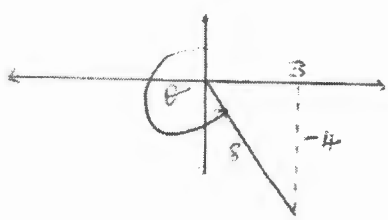


④



REFLECTIONS ON CLASSROOM OBSERVATION 2

DATE : 30 July 2009

SCHOOL : B

EDUCATOR : B

SUBJECT : Mathematics

TOPIC : Trigonometry (Equations)

GRADE : 12

DURATION : 40 minutes (11h00 – 11h40)

	STATEMENT	YES	N0	COMMENTS
1.	Is the classroom well arranged?	√		Learners sat in pairs facing the direction of the teacher.
2.	Is the teacher using the OBE style of teaching?	√		Question and answer method of teaching, allow learners to work in pairs.
3.	Is the teacher using other resources apart from the text book?	√		Chalkboard and charts.
4.	Does the teacher involve learners in the lesson?	√		Throughout the lesson.
5.	Does the teacher assess learners?	√		Ask learners questions.
6.	Does the teacher allow learners to ask questions?	√		Learners asked whenever there was a misunderstanding.
7.	Can the teacher link the lesson to everyday life?	√		Angles are used everywhere, the careers that you will be pursuing next year, (looks around the class) even our classroom have angles.
8.	Can the teacher demonstrate the connections of Mathematics to everyday life?	√		Angles are used in buildings, carpenters also use angles, architects, etc

Class work: see the attached document on the next page.

CLASSWORK

DRAW THE FOLLOWING GRAPHS:

(a) $y = \sin x$

(b) $y = \cos x$

(c) $y = \tan x$

Your intervals should be -360° and 360°

REFLECTIONS ON CLASSROOM OBSERVATION 3

DATE : 05 August 2009

SCHOOL : C

EDUCATOR : C

SUBJECT : Mathematics

TOPIC : Trigonometric Equations

GRADE : 11

DURATION : 45 minutes (9h00 – 9h45)

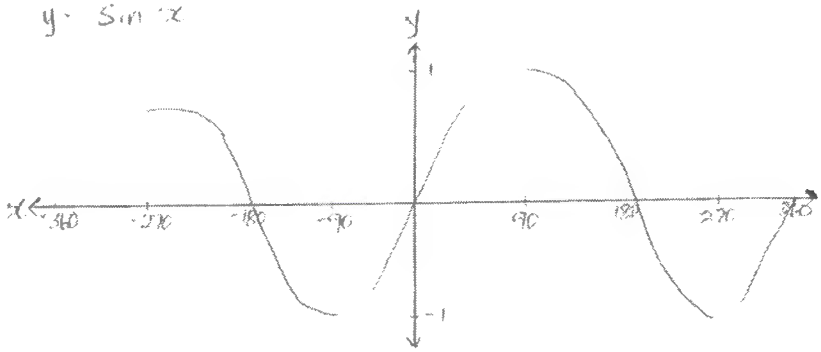
	STATEMENT	YES	N0	COMMENTS
1.	Is the classroom well arranged?	√		All learners sat on desks in pairs facing the direction of the teacher.
2.	Is the teacher using the OBE style of teaching?	√		Question and answer method of teaching.
3.	Is the teacher using other resources apart from the text book?	√		Chalkboard. Mathematics charts were on the classroom walls.
4.	Does the teacher involve learners in the lesson?	√		Ask learners questions, allow learners to explain their answers.
5.	Does the teacher assess learners?	√		Ask learners questions throughout the lesson.
6.	Does the teacher allow learners to ask questions?	√		Learners asked questions for further clarification.
7.	Can the teacher link the lesson to everyday life?	√		Used the story of the first people who went to the moon.
8.	Can the teacher demonstrate the connections of Mathematics to everyday life?	√		The theorem of Pythagoras used in buildings.

Class work: See the attached document on the next page.

NOTES

TRIGONOMETRIC EQUATIONS

$y = \sin x$



Solve for x between $-180° \leq x \leq 180°$.

EXAMPLE:

① $5 \sec(x - 70) + 8 = 0$

$5 \sec(x - 70) = -8$

$\sec(x - 70) = \frac{-8}{5}$

$\cos(x - 70) = \frac{-5}{8}$

$x - 70° = (180 - 51,3) + 360$

$\therefore x = 198,7 + 360$

OR

$x - 70° = (180 + 51,3) + 360$

$\therefore x = 301,3 + 360$

CLASSWORK

Solve for x between $-180° \leq x \leq 180°$

① $\tan^2 x - \tan x - 2 = 0$

② $3\cos^2 x - 5\sin x = 1$

REFLECTIONS ON CLASSROOM OBSERVATION 4

DATE : 05 August 2009

SCHOOL : D

EDUCATOR : D

SUBJECT : Mathematics

TOPIC : Angles and Lines (Supplementary and Complementary angles)

GRADE : 7

DURATION : 30 minutes (8h00 – 8h30)

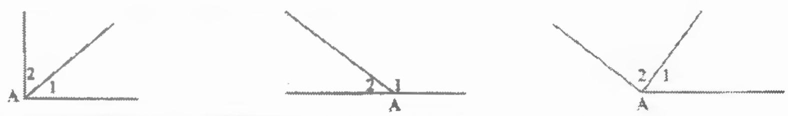
	STATEMENT	YES	N0	COMMENTS
1.	Is the classroom well arranged?	√		Learners sat in pairs facing the direction of the teacher.
2.	Is the teacher using the OBE style of teaching?	√		Question and answer method was implemented.
3.	Is the teacher using other resources apart from the text book?	√		Chalkboard, and charts on the classroom walls.
4.	Does the teacher involve learners in the lesson?	√		Give them exercises to solve in pairs.
5.	Does the teacher assess learners?	√		Ask questions throughout the lesson
6.	Does the teacher allow learners to ask questions?	√		Learners asked questions whenever they encountered problems.
7.	Can the teacher link the lesson to everyday life?	√		Angles give strength to the structure.
8.	Can the teacher demonstrate the connections of Mathematics to everyday life?	√		**Architects** – use angles in their building projects. **Doctors** – if an operation is done at a wrong angle, death may occur. The teacher explained that if you do not know angles, you are going to make a mess of your career.

Over-leaf are notes and exercises given to learners after the lesson.

Adjacent angles

Adjacent angles are 2 angles that lie next to one another, i.e. they have a common side.

Examples: $\hat{A}_1$ **and** $\hat{A}_2$ **are adjacent angles.**



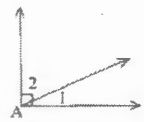
Complementary angles

2 Complementary angles add up to 90°.

$\hat{A}_1 + \hat{A}_2 = 90°$

$\therefore$ $\hat{A}_1$ and $\hat{A}_2$ are complementary.

Complement of : 40° is 50°
30° is 60°
5° is 85°
90° is 0°
18° is 72°
$x°$ is $(90-x)°$.



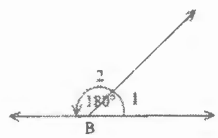
Supplementary angles

2 Supplementary angles add up to 180°.

$\hat{B}_1 + \hat{B}_2 = 180°$

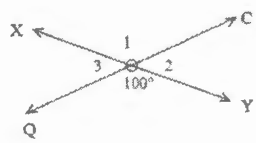
$\therefore$ $\hat{B}_1$ en $\hat{B}_2$ are supplementary.

Supplement of: 40° is 140°
100° is 80°
15° is 165°
90° is 90°
135° is 45°
$y°$ is $(180-y)°$
$(90-x)°$ is $(90+x)°$



Vertically opposite angles

If two straight lines intersect one another, the vertically opposite angles are equal.



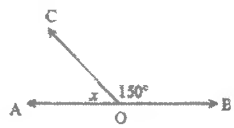
$\hat{1} = \hat{2}$ (Vertically opposite ∠ˢ)
$\hat{3} = \hat{4}$ (Vertically ∠ˢ)

$\hat{1} = 100°$ (Vertically opposite ∠ˢ)
$\hat{2} = 80°$ (Straight ∠)
$\hat{3} = \hat{2}$ (Vertically opposite ∠ˢ)
$= 80°$

Exercise: (Angles and lines)

1. Calculate the unknown angles in each of the following (**supply reasons**):

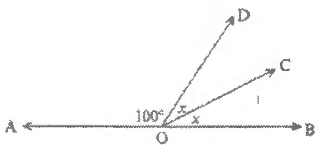
1.1



1.1 $x =$

Reason:

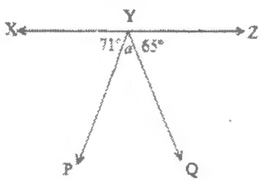
1.2



1.2 $x =$

Reason:

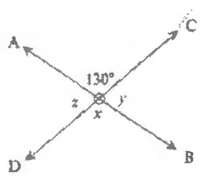
1.3



1.3 $a =$

Reason:

1.4



1.4 $x =$

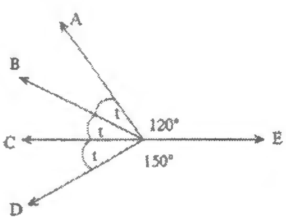
Reason:

$y =$

Reason:

$z =$ Reason:

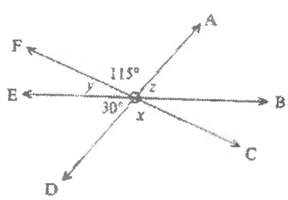
1.5



1.5 $t =$

Reason:

1.6



1.6 $x =$

Reason:

$y =$

Reason:

$z =$

Reason:

REFLECTIONS ON CLASSROOM OBSERVATION 5

DATE : 29 August 2009

SCHOOL : E

EDUCATOR : E

SUBJECT : Mathematics

TOPIC : Trigonometry (working with Polygons)

GRADE : 11

DURATION : 1h00 (10h00 – 11h00)

	STATEMENT	YES	N0	COMMENTS
1.	Is the classroom well arranged?	√		Learners are sat in pairs facing the direction of the educator.
2.	Is the teacher using the OBE style of teaching?	√		Allow learners to discuss in groups and check if the sine or cosine rules holds in the given examples. Sine rule: in any triangle ABC, $\sin A/a = \sin B/b = \sin C/c$ Cosine rule: in any triangle, $a^2 = b^2 + c^2 - 2bc \cos A$ $b^2 = a^2 + c^2 - 2ac \cos B$ $c^2 = a^2 + b^2 - 2ab \cos C$
3.	Is the teacher using other resources apart from the text book?	√		Chalkboard and charts
4.	Does the teacher involve learners in the lesson?	√		Answer questions, do given exercises in pairs and write the class work individually.
5.	Does the teacher assess learners?	√		Ask learners questions throughout the lesson and a class work at the end of the lesson.

6.	Does the teacher allow learners to ask questions?	√		During the lesson the teacher kept on asking : "do you understand? Is there any question?
7.	Can the teacher link the lesson to everyday life?	√		Mentioned that angles are everywhere and learners looked around the classroom and smiled.
8.	Can the teacher demonstrate the connections of Mathematics to everyday life?	√		Explained to learners that the knowledge of angles can be used in roofing, carpentry etc.

Classwork: See the attached documents on the next page.

NOTES

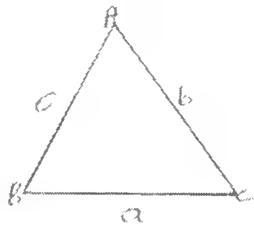
THE SINE RULE

THEOREM: IN ANY ΔABC,

$$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$$

OR

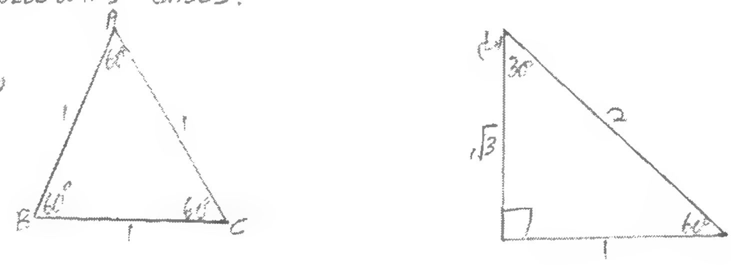
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$



CLASSWORK

CHECK IF THE SINE RULE HOLDS IN THE FOLLOWING CASES:

(a)



(c)