The contexts which Namibian learners in grades 8 to 10 prefer to use in Mathematics

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ABSTRACT

One of the key ideas in the research on mathematics education is that the mathematical knowledge that learners acquire is strongly tied to the particular situation in which it is learnt. This study investigated the contexts that learners in grades eight, nine and ten prefer to deal with in the learning of mathematics based on their personal, social, societal, cultural and contextual concerns or affinities. The study is situated in the large-scale project called the Relevance of School Mathematics Education II (ROSMEII), which is concerned with the application and the use of mathematical knowledge and processes in real life situations. It is based on a survey of learners from ten (10) secondary schools in the Oshana and Khomas regions of Namibia. The ten schools that were sampled represent the spectrum of schools in Namibia in both urban and semi-urban areas. The Rasch model of data analysis is employed to provide some insight into the contextual situations learners would like to deal with in their mathematical learning. The data obtained for this study was analysed using the WINSTEPS Version 3.65.0 suite of computer programs. The current study arises from a concern about the absence of the voices of learners in the contextual situations in mathematics selected by adults such as mathematics teachers, inspectorates and curriculum and materials developers. The assumption is that the inclusion of learners' insights into mathematics curricular might enhance mathematical learning.

The study reveals that school children have an intrinsic desire to learn about mathematical issues embedded in real-life contexts. Several items which Namibian learners have shown interest in are issues they experience in life out of school which are not directly dealt with in school, such as managing personal and financial affairs, health matters, technology, construction, engineering and government financial matters. However, learners indicated to have a low preference in contexts like lotteries and gambling, national and international politics, cultural products, all kinds of pop music and dancing. This thesis contends that the inclusion of contexts in the mathematics curriculum which are of interest to learners will go a long way in facilitating good performance of learners in mathematics.

KEYWORDS

Contexts in mathematics

Learners' interests in mathematics

Learners' preferences

Relevance of Mathematics

Affective issues

Real-life contexts

Rasch Analysis

ROSME

DECLARATION

I declare that *The contexts which Namibian learners in grades 8-10 prefer to use in Mathematics* is my work, that it has not been submitted before for any degree or examination in any other university, and that all the sources I have used or quoted have been indicated and acknowledged by complete references.

Loide Ndahafa Shifula November 2012

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This thesis is dedicated to my late father, Melkisedek Shifula -*'If only you could be here!'*-

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CHAPTER ONE

INTRODUCTION

The Ministry of Education in Namibia has a centralized curriculum decision-making mechanism, that is, it maintains the authority to decide, develop and control the curriculum, educational policies, syllabi and textbooks to be used in mathematics. The present curriculum design process is the preserve of experts in the mathematical content dispensation. Many effects transpire from the monopoly of adults and experts on the low mathematical performance of grade eight to ten learners in Namibia. However, teachers, policy makers and curriculum designers have different ideologies, interests, experiences and perspectives that stem from a variety of causes like political, religious, educational, economic and social backgrounds. These aspects can significantly affect the learners' mathematical education.

Education in Namibia is compulsory for learners aged between six and sixteen, which is from grade 1 to 10. The formal school system in Namibian government schools consists of 12 years of schooling broken down into four years of lower primary (Grade 1-4), four years of upper primary (Grade 4-7), three years of junior secondary (Grade 8-10) and two years of senior secondary (Grade 11-12). This study investigates the contexts that Namibian learners in Junior Secondary phase (grades eight, nine and ten) prefer to use in mathematics.

The study serves to motivate teachers, curriculum designers and policy developers, as well as mathematics advisory and inspection services to consider and include the 'voices' of learners in their teaching designs, particularly with respect to contextual domains which learners prefer to use in mathematics (Julie & Holtman, 2008, p. 379).

The present study contributes to the school mathematics education by bringing out the voices of grade eight to ten Namibian learners on real-life contexts which they are interested to learn in mathematics and mathematical literacy. The Organisation for Economic Co-operation and Development (OECD, 2006, p. 12) defines Mathematical Literacy as, "an individual's capacity to identify and understand the role that mathematics plays in the world, to make well-founded judgements and to use and engage with mathematics in ways that meets the needs of that individual's life as a constructive, concerned and reflective citizen." The OECD's definition is relevant to this study because it uses the term mathematical literacy to encapsulate the broader concept of mathematical knowledge, skills, competence, as well as the interests and liking of mathematics embodied in individual learners which are relevant to personal, social and economic wellbeing.

Mathematics is a subject which is not only useful in schools, but is also utilized in daily life activities. Therefore, learners need to possess a variety of mathematical skills that enable them to give appropriate recognition of what make sense to them and of what the learners themselves see as worth learning in mathematics education. This study investigated the real-life situations that learners at Junior Secondary phase in Oshana and Omusati region prefer to use in mathematics.

The study considers the contextual issues in mathematics as of paramount importance if one is to instil an attitude of performing mathematical tasks with interest.

1.1 Background and Motivation

Broadly, this study is situated in the large-scale project called the Relevance of School Mathematics Education II (ROSME II) of the Mathematics Education unit of the School of Science and Mathematics Education at the University of the Western Cape. The ROSME project was initiated to essentially investigate the contexts that learners in grades eight, nine and ten prefer to deal with in the learning of mathematics. The results of different ROSME studies triggered my curiosity into undertaking this study on the contexts that Namibian learners prefer to deal with in their mathematical studies.

Mathematics learning is influenced by learners' cognitive, affective as well as their social lives which form part of each learner's personal profile in the developmental domains based on mathematics. It is stated by Hannula (2006, p. 209) that, research in mathematics education has established that one's affective state has an effect on cognitive processes. Research has also confirmed a positive relationship between positive affect and learners' mathematical achievement (Julie & Mbekwa 2005, Barnes, 2006; Kim, 2006; Ndemo, 2006; Mutodi, 2006; Cornellisen, 2008; Julie and Holtman, 2008; Blaauw, 2009; Ngcobo, 2011 and Holtman, Julie, Mbekwa, Mtetwa & Ngcobo, 2011). It ought to be kept in mind that students have different interests which have some crucial influences on their mathematics learning (Holtman, Julie, Mbekwa, Mtetwa & Ngcobo, 2011). It is argued that finding out more about student beliefs, interests, gender aspects, as well as the effects of age can help improve mathematics education.

It is because of this new trend of mathematical education research on affective issues and the scarcity, if not non-existence, of research focusing on the contexts learners prefer to deal with in mathematics that the Relevance of School Mathematics Education (ROSME I) project was embarked upon. This study is carried out with the very same reasons as those of ROSME I. Based on mathematics for everyday life, the issue of relevance is important for motivating learners to learn mathematics with understanding. If learners feel that the mathematical topics they are studying have some direct relevance to their lives, they will be more willing to study them. This is true for Namibia as it is true for most countries in the world.

In my experience of teaching mathematics, much of my enthusiasm of teaching derives from the observation that every class is unique and so is every learner. Learners differ in their knowledge of mathematics, their motivation and their interests. This can clearly be reflected in learners' different level of concentration and performance in different subjects, including mathematics. When learners become personally involved in their mathematical learning and reflect on this learning, then a formation of interest takes place. The assumption of this study is that mathematical real life contexts might enable learners to develop their knowledge and skills in a way which encourages confidence, interest and provides satisfaction and enjoyment; as well as to develop their ability to apply mathematical content in the context of everyday situations.

The old Namibian mathematics curriculum also referred to contexts, but in contrasts to the new curriculum as it concentrated more on abstract strategies from memorizing algorithms and rules to stipulating specific examples in the learning of mathematics.

The new Namibian Mathematics Curriculum emphasizes a problem-centred approach to mathematics learning and the development of learners' problem solving ability. The Namibian Junior Secondary Mathematics Curriculum (2010) states that,

> everybody use mathematical practices in their daily lives, and the style of thinking that we recognize as mathematical is part of everyday functioning. All school graduates are expected to be numerate and the study of mathematics at the junior secondary level should contribute to the learner's ability to think logically, work systematically and accurately and solve real-world problems. Mathematics should provide learners access to viewing the world through numbers, shapes, algebra, measures and statistics that is informative and creative (pp. 1).

Therefore, drawing from the above quotation, mathematics education can be learned successfully when it is related to the needs, desires, preferences and expectations of the community and of learners in particular.

1.2 Problem statement and Research questions

The main aim of this study is to ascertain the contexts which Namibian grade 8 to 10 learners prefer to deal with in mathematics. In particular, the focus was on learners' interests in mathematics and what they perceived as relevant contexts to be used in mathematics. Based on this, the study sought to respond to the following research questions:

- Which contexts are the most preferred by learners to be dealt with in mathematics?
- Which contexts are the least preferred by learners to be dealt with in mathematics?
- Are there gender differences in the contexts which learners prefer?
- Are there differences in the contexts preferred by learners between the three grades mentioned above?

1.3 The location of the present study in Mathematics Education

The present day society holds many challenges, which have the potential to affect the quality of mathematics learning taking place in schools. These challenges are caused by the "demands, constraints and influences from the society in which the mathematics learning is taking place" (Bishop, Hart, Lerman & Nunes, 1993, p. 1). Therefore, learners need to develop their powers of mathematical thinking and a positive attitude towards the subject as well as a capacity to take responsibility for their own learning. This study argues that embedding mathematics within contexts which have an affective value to learners would facilitate an improvement in learners' performance in mathematics.

The present study deals with the contexts which learners would prefer to be included in mathematics and is concerned with the contextual situations selected by adults who lack the voices of learners. The real life situations to be used in mathematics need to include the effect of the use of contexts on learners' achievement and the ability of learners to identify mathematics in everyday activities.

Due to constant changes in everyday social activities and economical structures of the society, many mathematicians and researchers have made an immense contribution to the field of mathematics education. Mathematics Education is accepted as a discipline, as articulated by Niss (2006) that problems encountered in the learning of mathematics are often closely linked to the nature of mathematics and to its subjective and objective relevance to life in society. Niss (2006, p. 10) addresses the "state and trends" of applications and modelling in mathematics curriculum and presents a report card comprised ten phenomena, objects and *problématiques* of Mathematics Education.

These *problématiques* are presented by Niss (2006, p.11) as domains of individuals' affective notions which include experiences, emotions, attitudes and perspectives with regard to the learners' actual and potential encounters with mathematics. This study relates to affective issues, curriculum, policy environment and mathematical learning based on the learners' interest and preferences of mathematical real life contexts. However, as stated by Niss (1999, p. 21), it is fair to claim that the over-arching, ultimate end of the whole enterprise is to improve students' learning of mathematics and acquisition of mathematical competencies. While striving to contribute to theory building in mathematics education Niss (2006, pp. 10-11) suggests that,

> in order for a mathematical theory to be comprehensive enough to be worth its name, it would have to contain at least the following sub theories, each accounting for essential traits of mathematics education: a sub-theory of mathematics as a discipline and a subject in all its dimensions, including is nature and role in society and culture; and a sub-theory of individuals' affective and cognitive notions, beliefs, experiences, and perceptions with regard to their actual and potential encounters with mathematics, and the outcomes thereof, (...). These sub-theories have to account for situating their objects, situations, phenomena and processes in the environments that influence learners, be they scientific, biological, anthropological, linguistic, philosophical, economic, sociological, political, or ideological.

The above quotation theorises that, all of us use mathematical education in our daily lives, that is, in our societies and in our cultures. The type of analytic thinking we attach to different activities enable us to make conjectures and test them using such means as classifying, enumerating, ordering and build them into generalizations. The emphasis is that the learning of mathematics takes place in societal institutions under the influence of economic, political, ideological and organizational forces, which sometimes become educational issues, influenced by affective domains.

This study considered the importance of mathematical literacy which entails the individual competencies in using mathematical knowledge in a practical and functional way. The study aimed to establish knowledge and understanding on what interests and preferences learners hold in their mathematical learning based on their personal, social, societal, cultural and contextual variables. Niss (2007, p. 1298) states that, "research is done in mathematics education because we want to know why students do not get enough out of their mathematics". Hence, research is conducted to find out what needs to be done to remedy the situation around mathematical learning.

In some research studies based on affective issues like beliefs, attitudes, experiences, interests and perspectives pertaining to mathematics, a considerable effort is placed on the affective issues' relevance to mathematical learning. This include producing and appreciating imaginative and creative work arising from mathematical ideas, which can enhance the learners' skills to understand, interpret and make sense of everyday situations in mathematical terms. Considering the use of everyday real life situations in mathematics, this study undertook the survey of the related state of affairs among the grade eight to ten learners and brought them to the fore with the purpose of contributing to the improvement of the mathematics curriculum.

The inclusion of real life contexts could open doors for curriculum designers, material developers and policy makers to include the demand of what learners sees as mathematically relevant in the world around them as well as in their own studies. The present study aimed to mirror the affective domains and notions of learners towards mathematics, which might spell out and ascertain the mathematical knowledge and contexts which learners see as important, relevant and useful to them.

Mathematics has direct applications in a variety of real life everyday human experiences, for instance estimating, counting, locating, measuring, designing, building and so forth. Therefore, well documented knowledge of learners' interest on contextual issues will help educators, researchers and mathematic practitioners to become better at communicating with one another about the enterprise of mathematical learning.

1.4 Summary and Conclusion

This chapter dealt with the introduction, background and motivation to the study, problem statement and research questions as well as the location of the present study in Mathematics Education. The next chapter explores the scholarship related to the use of contexts in mathematics and mathematical literacy, affective issues in mathematics, learners' interests and preferences for real-life situations to be used in mathematics; relevance of mathematics and real life issues. Chapter three discusses the research design used in this study. The particular research approach used is motivated and the instrumentation, sampling, data collection and data analysis procedures are discussed. Chapter four dealt with the presentation and analysis of the collected data against the research questions. Chapter five highlights the conclusions and offers recommendations for further research.

CHAPTER 2

CONTEXTS IN MATHEMATICS

2.1 Introduction

The contexts preferred by grade eight, nine and ten learners were investigated in light of the following themes and key words: (i) affective issues in mathematics; (ii) learners' interests and preferences for real-life situations to be used in mathematics and their influence on mathematical learning; (iii) relevance of mathematics and real life issues; and (iv) the Relevance Of School Mathematics Education (ROSME) project and results of ROSME research in South Africa, Zimbabwe and Swaziland. These themes established theoretical lenses, through which I approached, studied, analysed and interpreted the result and phenomena developed in this research.

In particular, this study looked into affective domain issues in Mathematics Education. The issue of the use of real-life situations in mathematics has been receiving quite a lot of attention in research in Mathematics Education. Real-life situations or contexts are extra-mathematical situations, defined as "textual descriptions of situations assumed to be comprehensible to the reader, within which mathematical questions can be contextualised" (Verschaffel, Greer & De Corte, 2000, p. ii). In simple terms, "real-life situations refer to those day-to-day circumstances or contexts typically located outside of mathematics as opposed to the intra-mathematical environment" (Holtman, Julie, Mbekwa, Mtetwa & Ngcobo, 2011, p. 120). Therefore, the definition of real-life situations referred herein to an area of human activity embedded in the broad day-to-day settings in which individual learners live.

Proposals and recommendations which arise from different research theses and articles call for the inclusion of contextual issues in mathematics education (Julie & Mbekwa 2005, Barnes, 2006; Kim, 2006; Ndemo, 2006; Mutodi, 2006; Cornellisen, 2008; Julie and Holtman, 2008; Blaauw, 2009; Ngcobo, 2011 and Holtman, Julie, Mbekwa, Mtetwa & Ngcobo, 2011). This study considered the importance of contextual situations learners prefer for use in Mathematics which encapsulates individual competencies in using mathematical knowledge in real-life situations, in a practical and functional way. Affective issues like interests and preferences therefore need to be considered in mathematics. The following section dealt with the notion of affective issues in mathematical learning.

2.2 Affective issues in mathematics

This study pursued the real-life situations which Namibian learners would prefer to deal with in Mathematics. The interest of learners to particular contextual issues lies within the affective domain. Affective issues are defined as attitudinal responses to educational objects that serve as motivational factors for learners' self-esteem in mathematical learning (Goldin, Rösken & Törner, 2009, p. 114). Research in mathematics education points to the effect that learners perform better in subjects which they like and this make children to understand better a mathematics which is contextualized rather than a mathematics which is decontextualized.

For the purpose of this study, the term 'affective issues' is used to generally refer to learners' interest and preferences related to mathematical learning. The study discussed the role of affective issues to determine what learners prefer to deal with in mathematics education.

One goal of mathematics education is for learners to develop attitudes which make them likely to attend to mathematical phenomena encountered in everyday life and subsequently to acquire and apply mathematical knowledge for personal, social and global benefit (OECD, 2006, p. 10).

According to Hannula (2006), the two key elements of a desired affective disposition which may relate to personal, social and global benefit are self-confidence and motivation to learn mathematics. Therefore, it is essential that mathematical contexts should aim at motivating as well as enhancing the learners' self-confidence and beliefs. An individual's beliefs or "mathematical world view" is defined as a rational act of shaping how one engages in problem solving (Schoenfeld, 1985, p. 52). When learners apply their mathematical and numeracy knowledge and skills to solve problems, it will lead to mathematical learning that meets individuals' learning needs based on learners' affective disposition like mathematical interest. According to Clarkson, Hannula, Brinkmann, Pálsdottir and Rowland (2004, p. 17),

> affect in mathematics education has been studied for various reasons. Some researchers have been interested in the role of affect in mathematical problem solving, mathematical thinking or in learning of mathematics in general. Affective variables are sometimes seen as indicative of learning outcomes, sometimes as predictive of future success. Affect is also often seen as a case or a consequence of gender differences. However, few have argued that the effect of affect variables on students has a right to be considered as an important issue in its own right and not only in their relationships to students' cognitive abilities.

The above quotation clarifies how affective issues can play a role in determining aspects related to mathematical learning, for example learning outcomes as predictive of future success and as a case or a result of gender differences which the present study tried to research on. The aspects which relates to the mathematical interest of learners can positively influence the learning of mathematics.

It is therefore assumed that to change learners' perception and beliefs in mathematics, problems that are set in daily real life situation are necessary. Real life contexts in mathematics may enable learners to experience mathematics as useful and connected to everyday real world issues. The affective domain is seen by different researchers as having an important influence on learners' mathematical successes. In a survey paper on affect in mathematics education, McLeod (1992, p. 76) identifies three main concepts to describe the affective domain in mathematics education, namely, beliefs, attitudes and emotions. Together with the three concepts of beliefs, attitudes and emotions, McLeod acknowledged that there are other important concepts within the affective field, such as values, motivation, feeling, mood, conception and interest based on real-life experiences. Learners' interest in real-life experiences may serve to influence those individuals to enrich their mathematical learning and enable learners to relate their mathematics work to the activities encountered in their day-to-day living.

A case study conducted in the United States of America by Glendis and Strauss (2004, p. 97-99) reported on a group of underperforming students with negative attitudes and low self-confidence towards mathematical learning. The students were able to overcome many of their initial problems after an intervention that relates mathematical learning to the affective domain. Affective issues can be seen as indicative of productive learning outcomes of future mathematical success, which can facilitate learners' interests and experiences to be a bridge between real-life happenings and mathematics. This study therefore highlighted how affective issues play a role in learners' mathematical lives and how it influences their mathematical learning. Learners' interests and contextual preferences in mathematics will be discussed next.

2.3 Learners' interests and contextual preferences in mathematics and their influence on mathematical learning

Interest can be defined as a feeling or emotion that causes the individual to focus of attention on an object or event (Ngcobo, 2011, p. 36). Interests and preferences fall within the domain of affective issues, that is, what people like and what they dislike. This study essentially dealt with ordinal data based on learners' interest of particular contextual issues which lies within the affective domain in which this study is situated. According to Hannula (2006: p. 220), affective dimensions are seen in connection with individuals' personal mathematical goals. The author asserts that, interests form part of basic emotions and attitudes that have an important role in human's coping and adaptation [to mathematics] and are always present in human existence. It is through values, expectations and interests that learners may express liking and disliking of mathematics.

According to Mavhunga, Sjøberg, Mikalsen and Julie (2008, p. 363), interest is perhaps found in all children by virtue of their curiosity, which includes life experiences both in and out of school. Therefore, if learners are interested in mathematics that is based on contextual issues, learning will essentially become a process for making sense, generating meaning and acquiring or constructing mathematical learning with ease. The mathematical learning which is embedded in real life aspects may therefore encompass curiosity among learners. The learners' contextual interest and the genesis of beliefs in which mathematical interests are included, go hand in hand.

Therefore, “the learner searching for sense and meaning develops interest about the mathematical objects being studied, as well as beliefs about the role of meaning in mathematics” (Goldin, Rösken & Törner, 2009, p. 115).

The learners’ understanding of mathematical meaning can also enable them to appreciate that mathematics can be found in their day-to-day social life and that mathematics is widely used in the world. In a study conducted by Bradley, Sampson and Royal (2006, p. 21) the analysis detected that learners appear to be less interested in teaching practices that might be viewed as being tangential to their learning, such as the use of assessment results to drive teaching and learning.

But, still considered important among the less valued attributes among the students is the emphasis of mathematics in real life. Based on mathematical education that include real life situations, learners seem to care that the mathematics they are learning is meaningful and important for future success in school and beyond. Therefore, Bradley, Sampson and Royal (2006, p. 23) note that colleges and universities often use student evaluations to measure teaching and learning quality while student insights are rarely considered in evaluating quality teaching and learning in schools.

In another study on attitude toward mathematics and achievement, Ma and Kishor (1997, p. 32) draw from the assumption that although there is evidence that affect influences behaviour, there is also evidence that behaviour influences affect. In their meta-analysis the authors provide seemingly similar evidence about the relevance of gender. It was found that the correlation between liking mathematics and achievement is equal for both genders.

The fundamental issues of mathematical learning can be based on socio-economic, cultural, personal values and gender-based which are all aspects that have possible influence on children's interest in mathematics.

The familiarity of the contexts to both male and female learners might have a positive effect on affective issues and in that way facilitate the learning of mathematics (Ngcobo, 2011, p. 41). Therefore, the present study included contexts which young people encounter in the natural world, the social and the technological environment. Contexts enable curriculum designers and educators to design a teaching sequence that is sensitive to learners' needs, give learners the chance to position their learning and understanding in their own familiar knowledge and promote the reinvention of mathematics (Gravemeijer & Doorman, 1999, p. 115).

In another study, Anderson, Sjøberg and Mikalsen (2008, p. 357) argue that it is important to know the interests of learners and consider those interests in the process of designing the curricula. The consideration of learners' interest and preferences make subjects like mathematics relevant to the needs of all the learners and their communities. Learners' interests and their life experiences in the community are based on the economic, social, cultural, bio-physical and political environments of the child. The consideration of learners' everyday experiences therefore enhances mathematical interests which ascertain the contexts which learners would prefer to deal with in mathematics. Gunter, Estes and Mintz (2007, p. 125) state that the relationship between interest and relevance is no accident because learners are interested in learning about those things for which they have the greatest curiosity. This is substantiated by Ngcobo's (2011, p. 50) argument that,

> learners are mostly drawn to contexts that they perceived to impact on their future well being as well as technological contexts and those that are of social concern. Learners' attraction to context seemed to be influenced by their previous experiences, aspirations about the future and people around them. The learners' mathematical reasoning showed that they have some experiences about mathematics that caused them to want to learn it using contexts they preferred. The reasons also showed that learners are aware of the importance of mathematics in their lives.

To corroborate the above quotation, I have observed, during my own teaching experience that much of the learners' interests are based on their intrinsic qualities and in problem solving process based on mathematical activities that relates to their daily lives. Ngcobo (2011, p. 51) stresses that, seeking learners' view on contexts for learning school mathematics does not imply the abandonment of responsibility for curriculum making professionals nor does it mean giving learners free reign to make decisions. Rather, the seeking of learners' preferred contexts aims at giving them a chance to participate in the choice and development of learning opportunities.

The learners' interest in mathematics is further highlighted by the National Research Council study in the United States which finds that "when learning reflects students' prior knowledge, interests, culture and real-life experiences, students are more motivated to persist in their mathematical tasks" (Gunter, Estes & Mintz, 2007, p. 344). Since problems in everyday life do not present themselves in such neat forms, learners whose learning depends on the use of school-based cues will often be unable to apply their learning to 'real-world' situations. The school-based cues like mathematics rules can impede making the learning of mathematics to be more relevant and reflective to learners' real life world. Hence, the present study ascertained the contexts that Namibian learners in grades eight to ten most and least prefer to deal with in mathematics.

The domains of learners' mathematical interests and contextual preferences provide a relevant and useful framework for conceptualising what learners aspire to learn in mathematics. Every learner is an individual with his/her own needs, interests, pace of learning, preferences, experiences and abilities. Therefore, learners need to explore different real-life situations or contextual situations, make discoveries and deal with mathematical problem solving concerning their (learners') learning interests as recipients of mathematical education. The starting point for mathematical learning is the fact that the learner brings to school much knowledge and social experiences gained from the social and natural environments. After all,

> (…)learners live in societies with socio-economic, technological, political and cultural characteristics, they belong to gender, social and perhaps ethnic subgroups, they speak languages, they are subject to habits, traditions, etc., all of which act as boundary conditions, or preconditions, for their encounter with mathematical education (Niss, 2007, p. 1295).

The boundary conditions mentioned above encompass the purpose, roles and functions of mathematical education for different groups of learners that complement the personal values, opinions and perceptions of society and culture. On the use of societal and cultural contexts in mathematics, Hannula (2006, p. 228) draws attention to learners' preference for specific contexts by asserting that contextualization will enable learners to understand and appreciate the use of mathematics in their everyday life situations.

Mathematics that considers real life situations represents a shift in research towards the contexts that learners prefer because mathematics competence involves not just the knowing of content, but also its application in real life situations.

If learners' mathematical knowledge is drawn from socio-cultural factors, their everyday life situations can influence the learners' mathematical interest based on their preferred contextual issues.

In a study conducted in two Finnish schools by Shmakov and Hannula (2010, p. 145), the 7th grade-classes with different level of educational acquaintance with CheCha mathematics method took part in the study. CheCha is a teaching approach that is built around mathematics problems that are for the learners at the same time **Che**erful (entertaining, funny, cool) and **Cha**llenging (difficult).

An approach of CheCha mathematics is based on acknowledging the role of affect in mathematical learning, which facilitates the learners' positive emotions and can influence how learning occurs. This can also create a joyful atmosphere in the mathematical classroom and help maintain creativity in learners. The authors surveyed students' preferences of entertaining features in mathematics. In this survey, 40 seventh graders from the same three classes responded. The results of Shmakov and Hannula's (2010, p. 146) survey have shown that 74 % of the respondents mention reasons why mathematics can be entertaining. Half of the students mention incorporating playing chess in their mathematic lessons. Mathematical playful statements and problem solving began to be perceived positively and increasing the learners' motivation to learn. Learners use mathematical skills in most activities of their everyday life. According to Donaldson (2009), the engagement and fascination of learners in logical reasoning, analysis, problem-solving skills and creativity in their mathematical learning is evidence of learners' mathematical skills.

For example, some Scottish children attending an after-school mathematics club were asked about ways the school could improve learning in mathematics. Most children felt that they wanted more time to talk about what they were learning and spend less time completing exercises from textbooks: *"when you know you understand, there isn't any point doing the whole page"* (P7 child). *"We want more time talking and listening to each other rather than watching the teacher at the board"* (P6 child) (Donaldson, 2009, p. 19). Based on the learners' views, Donaldson (2009, p. 22) states that each week, children were encouraged to describe ways to improve mathematical activities. Subsequent sessions were adapted and improved based on children's suggestions and ideas, whereby the same learners were specifically asked about learning mathematics.

Since learners preferred to use more technology in their learning, the staff then identified a range of web-based games which supported the development of skills in mental calculation in an interesting and motivating way. Teaching staff uses many different approaches to obtain the learners' views by working alongside learners and make focused observations of their responses within learning experiences. Activities such as incorporating the learners' views in their own mathematical learning play a role in enhancing learners' interests in mathematics.

The Namibian mathematics curriculum for junior secondary level (grades 8-10) of schooling aims to provide a broad foundation for the day-to-day use of mathematics, the future study of mathematics and of other related disciplines based on learners' interests and contextual preferences. Learners are constantly faced with daily demands which require mathematical problem solving. These demands relates to interpreting graphs, hire-purchases, measuring, counting, using of technological equipment, investments etc.

The curriculum emphasis is therefore put on the use and application of mathematical knowledge and relevance of mathematical skills in real-life situations. The relevance of mathematical contextual issues will be discussed next.

2.4 Relevance of Mathematical Literacy and real life issues

The consideration of what learners may see as real-life situations which are mathematically relevant serves as a directive that is needed at secondary school levels to encourage debates about the importance of mathematics education in the society. The Namibian Junior Secondary Mathematics Curriculum (2007, p. 3) emphasised that learners should be provided with the essential mathematical knowledge to cope with the numeracy demands of the modern world.

The provision of mathematical knowledge based on real-life situations can serve to motivate learners' interest and desire to learn mathematics. In the same vein, the South African Department of Education (DoE) (2003, p. 10) curriculum statement implemented Mathematical Literacy as the subject that "provides learners with an awareness and understanding of the role that mathematics plays in the modern world. It is also a subject driven by life-related application of mathematics.

The learning of Mathematics which is embedded in real-life situations enables learners to "develop the ability and confidence to think numerically in order to interpret and critically analyse everyday situations and to solve problems" (DoE, 2003, p. 11). The critical and developmental outcomes of Mathematical Literacy, as stipulated in the South African curriculum statement propose to enable learners to use their mathematical knowledge to investigate a range of different real life aspects like financial, personal, business, technology, national issues etc.

The purpose of Mathematical Literacy is to connect mathematics to real world as well as to use mathematical contexts in a variety of situations. There are however other mathematical contexts such as reading maps, timetabling, understanding house plans, mortgage bonds, insurance, pension etc. which are embedded in mathematical contexts that learners may prefer to deal with. The contexts preferred by learners are normally informed by the real life situations based on their historical, economical, cultural and societal dimensions. Learners develop interest about their mathematical learning abilities especially when they start seeing the relevance of the subject matter to their lives and how mathematics relates to real life situation in general. From this experience, "learners could develop positive attitudes about what mathematics is, how it is learnt and how it is relevant to real life" (Biccard & Wessles, 2011, p. 7).

The use of real life aspects in mathematical literacy is emphasised by Barnes (2006, p. 13) by highlighting that "the government, learners, parents, teachers, industry and business have expressed the need for mathematics to be relevant" to the interests and preferences of learners and their society. Failure to incorporate learners' interests and preferences in mathematical contexts that are related to real-life issues might result in confused personal decision and poorly informed decision-making in future professional and public life of learners.

It is therefore imperative for learners to deal with mathematical problems that are based on real-world activities so that they can make connections between the mathematical content learned in the classroom and the world in which they live. Learners need to be exposed to varied and interrelated experiences that encourage them to understand and appreciate the role of mathematical education in the society.

The current societal trend is that more occupations require the person's ability to use, communicate, relate, understand and explain concepts and procedures based on real life contexts embedded in mathematics. The relevance of mathematical education is emphasized by Foresman and Wesley (2004, p. 28) when they state that,

> mathematics is crucial not only for success in school, but in being an informed citizen, being productive in one's chosen career and in personal fulfilment. In today's technology driven society, greater demands have been placed on individuals to interpret and use mathematics to make sense of information and complex situations. As a result, most schools place the understanding, application of numbers and operations, algebra, geometry, measurement, data analysis, problem-solving and reasoning skills as a top priority.

This follows that, learners' knowledge of problem-solving; reasoning and application of mathematics to real-life situations highlight the notion of mathematical relevance. Through their mathematical experiences based on real-life world, learners are expected to have a strong understanding of mathematical concepts and processes, reasoning and analysis while using mathematics to make sense of, and to solve complex problems in a variety of real-life applications. According to Downe (2008, p. 53),

> mathematics education prepares students for the everyday problem solving that they need to succeed in the real world. It is an age old question in math classes: "Why do we have to learn this? When are we ever going to use this in our lives?" But, in everyday life, we are all faced with many problems, where we are required to make complex decisions. The school system cannot possibly simulate all different things that are going to happen to all of the different people to prepare them for life. It can, however, put the learners in a situation in which learners have to figure out what they have to do, rather than memorize a solution.

Drawing from the above quotation and from the results of different ROSME studies, the notion of learners' interest in real-life situations becomes clearer on the kinds of contexts learners prefer to be included in the mathematical content which they learn at school. Learners prefer to deal with mathematics that is related or relevant to their daily practical living.

Specifically, a motivation for my research and as mentioned in the quotation above, is that most learners ask their teachers to explain when and where in their future will they use some mathematics which they are learning at school. In addition, making connections between the mathematics that learners learn at school and its applications in their everyday lives not only will it help learners to understand mathematics but also allow them to see how "useful and relevant mathematics is in the world beyond the classroom" (The Ontario Mathematics Curriculum, 2004, p. 19). Therefore, learners need to be provided with mathematical skills that deal with real-life issues and competences which may help them to cope with life as citizens in various spheres in which they live which include education, occupation, private life and social life.

Different countries build their mathematics curriculum with a consideration of societal changes. For example, the Ontario Ministry of Education Curriculum (2005, p. 3) for mathematics Grades one to eight provides the framework needed to keep abreast of the societal trends, as the curriculum stipulates that,

> an information- and technology-based society requires individuals who are able to think critically about complex issues, analyze and adapt to new situations, solve problems of various kinds and communicate their thinking effectively. The study of mathematics equips students with knowledge, skills and habits of mind that are essential for successful and rewarding participation in such a society.

> To learn mathematics in a way that will serve them well throughout their lives, students need classroom experiences that help them develop mathematical understanding; learn important facts, skills and procedures; develop the ability to apply the processes of mathematics; and acquire a positive attitude towards mathematics.

This quotation brings out the notion of changes in the society based on information and technology (IT) and how it manifests itself in mathematical education. One of the Namibia National Curriculum guidelines is to provide insight and understanding of crucial “global” issues in a rapidly changing world which affect quality of life, which are, the AIDS pandemic, global warming, environmental degradation, distribution of wealth, expanding and increasing conflicts, the technological explosion and increased connectivity.

It is stated in the Namibian National Curriculum Guidelines (2010) that, “if the Curriculum objectives and learners’ learning competencies in learning mathematics are to be realized, access to information and proper mathematical curriculum planning are further preconditions for successful learning”. Therefore, the learners’ positive attitude towards mathematics need to be shaped as a motivation where the learners’ contextual input can be recognized and involved in materials development so that learners are able to see the relevance and usefulness of mathematics.

A report of the National Academy of Sciences (NAS, 1997, p. 1) highlighted that society's technological, economic and cultural changes have made many important mathematical ideas more relevant and accessible in work and in everyday life. Furthermore, the NAS (1997) report neatly summarizes this point that,

> (…) an understanding of science, mathematics and technology is very important in the workplace. As routine mechanical and clerical tasks become computerized, more and more jobs require high-level skills that involve critical thinking, problem solving,

> communicating ideas to others and collaborating effectively. Many of these jobs build on skills developed through high-quality science, mathematics and technology education. Specifically, there is rich mathematics in workplace applications and in everyday life that can contribute to the school curriculum. Thus, the world provides compelling examples of mathematical ideas in everyday and workplace settings. These examples can broaden the nation's mathematics education programs to encompass the dual objectives of preparing students for the worlds of work and of higher education (p. 1).

Sharing the same sentiment, the Ministry of Higher Education Vocational Training Science and Technology (MHEVTST) in Namibia, emphasises the relevance of mathematical programmes which aims at involving the learners' mathematical academic pursuits in their daily lives; inspiring new talents and fuel the enthusiasm of learners toward their mathematical work; and demonstrating contributions to social changes and progress through the application of mathematics to real-life situations (MHEVTST, 1999, p. 37).

Even though the Namibian Ministry of Education (MoE, 2007, p. 3) emphasises the relevance of mathematical studies, it has been shown quite alarmingly in recent years that only a few learners are gaining the basic skills of functional literacy and numeracy at the end of their junior secondary education in Namibia.

The relevance of mathematics which involves both the various applications of mathematics and the position of mathematics in the spectrum of human real life situations need to be considered in the learning programmes. This will equip learners with better knowledge that enable them to apply the mathematical logic and analytic thinking skills to other areas of mathematical learning.

To test the mathematical notion of communicating, understanding and explaining concepts and procedures based on mathematical learning, the eco-house project in Scotland challenges young people to design and build a house of the future which is environmentally friendly. Working with partners from construction, architectural services and environmental groups, the project develop a range of skills for life and skills for work. Learners could see the purpose and relevance of developing and applying a range of mathematical skills, including estimating, measuring, budgeting and problem solving (Building the Curriculum 1, 2010: Online).

Just like in many countries in the world, the Namibian learners need to acquire mathematical knowledge and skills that are relevant to their future wellbeing in the society. Problems that learners often encounter in the learning of mathematics are often closely linked to the nature of mathematical content and to its subjective and objective relevance to real life settings in society.

There are however some stumbling blocks in the way of making mathematic education relevant to needs of the society. These stumbling blocks revolve around the rigid, centralized decision-making processes imposed by the experts, which hinder schools from responding and adapting to the mathematics curriculum to suit the needs of learners' real-life problems. What teachers and curriculum developers know and believe about mathematical and learning is, in many cases, limited to what they have been exposed to during their time as learners in classrooms. Ngcobo (2011, p. 53) asserts that, the inability to expose learners on how relevant are contexts to school mathematics can contributes to learners' negatives attitudes towards school mathematics as well as low achievement in mathematics.

Socio-cultural factors embedded in people's everyday lives, for example Information technology (IT), gives rise to major transformations in mathematics education. To improve quality and relevance in different components of learning standards and curriculum development in mathematics education, there is a need for some spearheading agency of educational reform. This research is aimed at being one of the spearheading agencies for the consideration of learners' contextual interests in school mathematics.

Even though there are some variations in the views held by different researchers, mathematicians, mathematics educators and material developers on the learners' learning processes, a fair amount of agreement seems to prevail on understanding, reasoning, creativity, problem solving and the ability to apply mathematics in extra-mathematical contexts and situations. The relevance referred to or that can be extracted by different authors pertaining to the mathematical learning process was viewed under varying circumstances and domains which are considered in this study as well as in other ROSME studies as discussed below.

2.5 ROSME and results of ROSME research in South Africa, Zimbabwe and Swaziland

As mentioned in chapter 1, this study is part of the Relevance of School Mathematics Education (ROSMEII) project, which is a multi-country project ascertaining the contextual situations learners in grade eight to ten prefer to deal with in mathematics.

According to Julie and Holtman (2008, p. 379), the Relevance of School Mathematics Education (ROSME) project is situated within an area of research in mathematics education which considers student voice an important issue in school mathematics curricula and other issues related to the school mathematics enterprise. Julie and Mbekwa (2005, p. 33) describe the inception of ROSME by a group of educators from South Africa, Eritrea, Swaziland, Uganda, Zimbabwe and Norway who came together early in 2003 to start working on the ROSME project. The group then decided on the survey method using a questionnaire to best capture and evaluate data that would reflect the contexts preferred by grades 8, 9 and 10 mathematics learners.

After piloting the initial questionnaire, the participants conducted different ROSME survey studies in their respective countries. The researchers used the sixty-one item questionnaire, which included fifty closed-ended questions that learners have to answer on a Likert scale.

Just like the present Namibian study, grades 8, 9 and 10 learners were targeted based on the fact that these grades normally indicate the culmination of compulsory schooling and the onset of final three year of schooling (Julie & Holtman, 2008, p. 382). Julie & Holtman's (2008, p. 379) study compares six countries, but this study discuss the similarities and differences in ranking positions relative to the five highest and five lowest ranking of items of studies done in South Africa, Zimbabwe and Swaziland. These countries are situated in the Sub-Saharan region where Namibia is located. All three countries are members of Southern Africa Development Countries (SADC), of which Namibia is also a member.

Another reason for considering the aforementioned countries is that the research population of other researchers is in a same range as the present study (900-1200 participants). Julie and Holtman's (2008) study on relevance of school mathematics education compares the ranking of five highest and five lowest items of only three countries out of six countries that took part in ROSMEI. The results of the study show that there is consistency in the findings of the three sub-Saharan countries.

The consistency in how learners endorse items is clear, whereby learners ranked items C11 (mathematics that is relevant to professionals such as engineers, lawyers and accountants), C15 (mathematics involved in secret codes such as pin numbers used for withdrawing money from an ATM) and C47 (mathematics involved in working out financial plans for profit making) among the five most preferred items. Since these three items deals with employment, modern technology and financial matters, Julie and Holtman (2008) conjecture that,

> the items (C11, C15 and C47) are linked to the developmental status of the sub-Saharan countries and awareness among learners from these countries indicates that the improvement of their economic capital will be linked to their own entrepreneurial initiatives, which highlights the dominance of interest in modern technological aspects (pp. 394-396).

It is hereby argued that, learners (irrespective of the development status of their countries) have interest in technological matters. Furthermore, respondents from these developing countries appraise the high-status professions such as engineers, lawyers and accountants and the desire for such knowledge is brought to the fore in the rankings. The dominance of interest in modern technological issues and interest in dealing with the mathematisation tend to have high currency which is strengthened by the high preference accorded to these items in the three sub-Saharan countries. On another angle, Swaziland ranked items C21 (mathematics to assist in the determination of the level of development regarding employment, education and poverty in my community) and C22 (mathematics to prescribe the amount of medicine a sick person must take) among the five most preferred items. This emphasizes an ardent desire of young people in the future development of their country. Therefore, this calls for school mathematics curricula to be based on mathematical contexts that relate to learners' real-life situations.

All three sub-Saharan countries accorded items C2 (mathematics of a lottery and gambling) and C43 (mathematics linked to decorations such as the house decorations made by Ndebele women) a low preference. This highlights that learners in South Africa, Swaziland and Zimbabwe are aware of the negative effects that affect the communities as a result of misuse of financial resources in lotteries and gambling which leads to poverty among households. According to Julie and Holtman (2008, p. 391), the results were surprising in that item C43 (mathematics linked to decorations such as the house decorations made by Ndebele women) which deal with indigenous knowledge, ethnomathematics and mathematisation of cultural artefacts was accorded low preference by the respondents of these countries. Furthermore, Julie and Holtman (2008) asserts that,

> the cultural knowledge area in mathematics research and mathematics education has its origin in developing environments. The expectation is that ideas and activities from an ethnomathematical perspective would have filtered to the classroom level, but young school-going adults in sub-Saharan countries do not, as yet, perceive this as relevant in their mathematics (p. 392).

This lack of interest in cultural knowledge among the youth can be attributed to the way young school-going adults have been overtaken by the Western cultures.

A disparity in contexts preferred between rural and urban learners has emerged from the responses given in the three studies. The low preference ranking of items C14 (mathematics needed to work out the amount of fertilizer needed to grow a certain crop), C17 (mathematics involved in deciding the number of cattle, sheep or reindeer to graze in a field of a certain size), C36 (mathematics involved in working out the best arrangement for planting seeds) and C37 (mathematics needed to determine the number of fish in a lake, river or a certain section of the sea) by South Africa and Swaziland might be linked to the sample representation which focuses on urban and semi-urban areas.

The results of a similar study by Holtman, Julie, Mbekwa, Mtetwa and Ngcobo (2011) reveal that the young people in South Africa, Swaziland and Zimbabwe "share similar affective orientations with respect to certain real-life situations. The real-life situations that the learners in these countries prefer most are related to electronic gadgets and personal finance, whilst the items they are least interested in are issues relating to gambling, cultural and agricultural practices". People living in urban and semi-urban do not indulge much in farming, gardening and plantation activities which might have cause the low interest of agricultural activities among the learners in those two countries.

In contrast to South Africa and Swaziland, the Zimbabwean sample has shown low preference and less interest in mathematical issues pertaining to youth cultures. The study results of the three Sub-Saharan countries discussed herein have some direct relation in informing the analysis of the five most preferred items and the five least preferred items in the present study.

2.6 Summary and Conclusion

In this chapter I attempted to provide a literature overview of the main research aspects by defining, describing and discussing issues related to the preferred contexts in school mathematics. In my attempt to do so, I tried to link learners' contextual interest and preference to the use of real-life situations in mathematical literacy. A review of literature also engaged with some of the ROSME studies done in three sub-Saharan countries like South Africa, Zimbabwe and Swaziland that were done prior to the present topic.

The next chapter focuses on, and explains the research methodology. It gives the reasons why a survey research format was used for this study and describes the sample and the research instrument used. It gives the background and description of the learners and schools sampled. It goes on to provide the procedures of data analysis.

CHAPTER THREE

RESEARCH DESIGN

3.1 Introduction

As mentioned in chapter 2, this study forms part of the Relevance Of School Mathematics Education (ROSME I) project. Therefore, the research design of this study follows in the footsteps of other survey studies which were undertaken in different countries like South Africa, South Korea, Zimbabwe, Uganda, Swaziland etc. (Julie & Mbekwa 2005, Barnes, 2006; Kim, 2006; Ndemo, 2006; Mutodi, 2006; Cornellisen, 2008; Julie and Holtman, 2008; Blaauw, 2009; Ngcobo, 2011). The present study is directly connected to previous related studies which dealt with contextual issues that learners prefer to deal with in mathematics education.

This study is the first one of its kind to be done in Namibia. The study was triggered by my interest in determining the order preferences Namibian learners in grade eight to ten have for contexts related to real life situations to be used in mathematics. This chapter discusses and explains the research design under the following headings: survey design, the questionnaire, sampling, ethical considerations, data analysis procedures, issues of validity and reliability.

3.2 Survey Design

The research design adopted for this study is survey design. Babbie and Mouton (2001, p. 52) state that survey is an excellent vehicle for measuring attitudes and orientation in a large population. The authors describe survey research as a best method available to social scientists who are interested in collecting original data, for example, describing a population which might be too large to observe directly.

There are different kinds of surveys but this study falls into the category of descriptive surveys which aim to provide "true quantitative descriptions of aspects of a universe and of people or things" (Simon, 1969, p. 193).

Descriptive research involves:

> collecting numerical data to test hypotheses or answer questions concerning current status which is then conducted either through self-reports, questionnaires, interviews or through observations. Descriptive research seeks to ascertain respondents' perspectives or experiences on a specified subject in a predetermined structured manner. All survey researchers use descriptive statistical methods to summarize data and get a description of the responses to questions (Babbie, 1989, p. 64).

Therefore, descriptive research is taken as fact-finding with adequate interpretation and the main goal of this type of research is to describe the data and characteristics about what is being studied.

The main aim of quantitative research is to establish facts, statistically describe, explain and predict phenomena and show relationships between variables (Gall, Gall and Borg, 2003: 289). The purpose of using descriptive survey in this study was to obtain factual and systematic data concerning the mathematical interests and preferences based on contextual issues that learners deal with in their daily lives.

Furthermore, the idea of using this type of research was to study frequencies, averages and other statistical calculations on the item responses of learners. The research literature states that, survey is normally used when the research interest is in gaining information about people's perceptions of preferences with regard to interests in, and attitudes toward issues of importance to the researchers.

To consider and reinforce the importance of surveys, Simon (1969, p. 193) makes a distinction between a survey and an experiment that, the former takes the world as it comes without trying to alter it, whereas the latter systematically alters some aspects of the world in order to see what changes follow. The current study aimed to capture the learners' interests in contextual situations to be used in Mathematics as they are, using survey research design. Like any other data collection methods, surveys have advantages and disadvantages as stipulated below.

Advantages of the Survey Method of Research

The following represents a summary of the advantages of surveys as stated by Simon (1969, p. 191).

1. With a survey, a researcher can get closer to the "real" hypothetical variables than with laboratory experiment. One can actually inspect the variables in their real-world setting.
2. A survey is often quite cheap, especially if one can use already existing records and data.
3. Huge masses of data are often already available or can be culled from existing records. This is a major statistical advantage, because the large samples provide high internal reliability. Such huge samples are seldom available in experimentation.
4. Surveys can yield a very rich understanding of people both in breadth by collecting a wealth of information, and in depth by probing people's motives.

Disadvantages of the Survey Method of Research

Simon (1969, p. 192) lists the major disadvantages of surveys as follows:

1. The crucial disadvantage of the survey method is the lack of manipulation of the independent variable.
2. One cannot progressively investigate one aspect after another of the independent variable to get close to the "real" cause.
3. Statistical devices are not always able to separate the effects of several independent variables when there is multivariable causation, especially when two independent variables are themselves highly associated.

The advantages and disadvantages classify survey as one of the approaches of quantitative research which mainly uses fixed–choice response formats to questions of importance to the issue being investigated. Surveys traditionally aim to describe the properties of large populations (usually of individuals) through studying the properties of a representative sample. The questionnaire used in this survey study will be expounded on in the following section.

3.3 The questionnaire

According to Hannula (2006, p. 226), research on affect can be divided into three approaches: observation, interviews and questionnaires. Therefore, in order to best capture and evaluate data that would reflect the contexts preferred by Namibian grades 8, 9 and 10 mathematics learners, this study employed the revised self-administered individual questionnaire compiled by the ROSME group. The questionnaire used in this study is a revised version of the initial ROSME I questionnaire which had 61 items. The ROSME questionnaire used in this study has been reviewed and reduced to 23 items. The reduction of items on the questionnaire was done through research aimed at improving the instrument.

The present study therefore used ROSME II questionnaire which consists of 23 items comprised of closed-ended questions that direct participants to certain choices among provided options. The twenty-three item questionnaire used in the present study is shown as Appendix A. The questions were in a form of short statements that reflect on the underlying day-to-day experiences which had the potential to be mathematised. The items in the questionnaire were framed in situations of life in general and are not limited to school life.

The items in a questionnaire are based on extra-mathematical issues as encountered in learners' real-life situations, for example health matters, culture, politics, environment, technology, mathematical general practices in life sciences, etc. The extra-mathematical clusters were mainly informed by modules and learning materials to ensure compliance with the possible mathematical treatment of the items which were developed as indicators of the identified clusters (Julie & Mbekwa, 2005, p. 33). The clusters, number of items in a cluster and an exemplar item used in ROSME II are indicated in Table 2.

Table 2. Clusters, number of items per cluster and exemplar item

Cluster	*Number of items*	*Exemplar indicator item*
Community Affairs	3	Mathematics involved in being productive in a community such as assigning people to tasks to be completed
Health	2	Mathematics involved in determining the state of a person
Physical Science	1	Mathematics involved in making complex structures such as bridges
Technology	2	Mathematics involved in secret codes such as pin numbers used for withdrawing money from an ATM
Transport and delivery	1	Mathematics involved in the sending of messages by SMS, cell phones and e-mails
Geography	3	Mathematics involved in environmental issues
Crime	1	Mathematics involved in setting up a crime barometer for my area.
Culture and traditions	1	Mathematics involved in cultural products and traditions
Youth Culture	3	Mathematics linked to music from the United States, Britain and other such countries

Politics	1	Mathematics used to calculate the number of seats for parliament given to political parties after elections
Agriculture	1	Mathematics involved in agricultural matters
Leisure and entertainment	2	Mathematics involved in playing sport and games of uncertain outcome for the gain and loss
Economy	2	Mathematics involved in personal, business or public finances

Column one of the Table 2 contains the broad categories or clusters into which the items fall, while column two indicates the number of items per cluster. The questionnaire was used in gathering objective, quantitative data and it captured aspects like the respondents' demographic information of age, grade level and gender.

Furthermore, the questionnaire consisted of twenty-three closed items based on a four-point Likert scale indicating the level of interest as very low, low, high and very high. Learners had to indicate the extent of their interest by placing a cross over or beside their preferred items. The questionnaire had clear examples which made it more communicative to grade 8-10 learners, with a broader use of language to describe and present contexts that the learners might authentically prefer to use in their mathematics.

As mentioned above, learner-friendly instructions and directions were given in the questionnaire where for example at the beginning of the questionnaire it was stated: "*what would you like to learn about in mathematics? There are no correct answers: we want you to tell us what you like*". Words such as "*me*", "*my*" and "*person*" appeared to put some items personally closer to learners. The main question attached to all items was: *My interest in learning about mathematics involved in (...) is:* "*very high*", "*high*", "*low*" and "*very low*". Scores of 1, 2, 3 and 4 were assigned to these four levels of interests giving "*very low*" a score of 1 and the label 4 given to "*very high*".

The four-point Likert-scale was therefore the best possible method of getting the data needed for studying the contexts preferred by the learners. Julie and Mbekwa (2005, p. 35) explain that the items were developed based on their amenability for mathematical treatment and the collective consensus of a group of mathematic teachers and educators about the issues which interest or not interest young people. Julie, Holtman and Mbekwa (2011, p. 2) assert that, in terms of affective domain issues, the survey instruments used are normally concerned with a latent trait or variable which is operationalised through the questionnaire items.

The contexts used in the research literature on context-driven mathematics also informed the identification of items as indicators of the construct ‘students’ preference of contextual situations to be used in school mathematics. Thus, a questionnaire effectively comprised a set of items which are realisations of the latent trait being investigated, and respondents were requested to rate each item on the scale. Therefore, it was expected that learners respond more or less equally across the four response categories on the questionnaire. The sample of the study will be discussed next.

3.4 Sampling

The sample of this study comprised of ten (10) secondary schools from the Khomas and Oshana regions of Namibia. The sample was based on surveying grade eight to ten learners in government schools that I had access to. Namibia has 13 educational regions; Khomas is the most central region in which Windhoek, the capital city of Namibia is located, while Oshana region is the biggest of all thirteen regions.

The two regions were selected because they are the two most urbanized educational and geographical regions in Namibia. Learners in the selected schools move from different rural and urban regions with different socio-economic backgrounds, to go and attend schools in these regions (Khomas and Oshana). The selection of participants was based on the "plausible assumption that such learners have an interest in the real-life situations that are dealt with in Mathematical Literacy" (Julie, Holtman & Mbekwa, 2011, p. 14).

In addition, the ten selected schools possess most characteristics of the majority of schools in the Khomas and Oshana regions. In terms of performance, commitment, and leadership and management, there are no substantial differences between junior secondary levels in different regions and in Namibia as a whole. Thus, the ten selected schools represent the majority of schools in most regions in Namibia.

As mentioned above, the present study used a convenient sampling technique, whereby learners from ten (10) secondary schools were randomly selected. Students from middle to high socio-economic environments in the northern and central regions of Namibia were selected for this study, whereby a 23-items questionnaire was used to collect data. The age distribution of the sample is given in Table 3.

Table 3. Age distribution

	Age	*Frequency*	*Percent*	*Cumulative Percent*
Valid	11	2	0.2	0.2
	12	8	0.7	0.9
	13	57	5.2	6.1
	14	208	19.0	25.1
	15	284	26.0	51.1
	16	314	28.7	79.8
	17	155	14.2	94.0
	18	41	3.7	97.7
	19	12	1.1	98.8
	20	7	0.6	99.5
	21	2	0.2	99.6
Invalid		4	0.4	100.0
Total		1094	100.0	

The invalid numbers represent questionnaires of those learners who did not provide a response for their age. Percentages provide a good picture of learners' sampled from each of the three grades. The data analysis gives the median ages of 14, 15, and 16 for grades 8, 9, and 10 respectively as one would expect. Based on the fact that learners in the two regions represented a convenient sample from rural and urban areas, the participants in this study will be a fair representation of grades 8-10 Namibian school-going learners in all thirteen regions. The following Table shows the representation of the total number of grade eight to ten learners who took part in the study from each school. The table shows a 100% response, which indicates that all grade 8 to 10 learners who were issued with questionnaires in ten schools, agreed to participate in the study and hence completed the questionnaire.

Table 4. Representation of the number of grade eight to ten learners per school

School code	*Frequency*	*Percentage*	*Cumulative Percent*
A	115	10.5	10.5
B	110	10.1	20.6
C	130	11.9	32.4
D	112	10.2	42.7
E	96	8.8	51.5
F	104	9.5	61.0
G	117	10.7	71.7
H	114	10.4	82.1
I	93	8.5	90.6
J	103	9.4	100.0
Total	1094	100.0	

Table 5. Demographics of cohort

		NUMBER	*PERCENTAGE*	*TOTAL*
GENDER	*BOYS*	466	42.6	1094 (100%)
	GIRLS	627	57.3	
	Invalid	1	0.1	
SCHOOL GRADE	*8*	379	34.6	1094 (100%)
	9	354	32.4	
	10	361	33.0	
GEOGRAPHICAL LOCATION	*URBAN*	531	48.5	1094 (100%)
	SEMI URBAN	563	51.5	

Table 5 reflects the number of participants from urban and semi-urban groups. Apart from a small numerical disparity in an overall gender representation whereby females slightly out-numbered males, it can be noted that there is a fair gender representation from all three grades as well as from geographical locations. The data indicate a slight balance sample representation from all three grades in both urban and semi-urban regions. A fair sample representation can be observed in the number of grades 8, 9 and 10 learners which is 379, 354 and 361 respectively. The total number of boys and girls that took part in the study in each region is summarized in Table 6 and the total number of learners per grade and per region is summarized in Table 7 (Appendix B). Only one Grade eight, one Grade nine, one Grade ten class at a selected school completed a questionnaire during the process of data collection as discussed below.

3.5 Data Collection

I allocated one day per school to complete the data collection procedures. This was a lengthy process but due to the learners' cooperation, I successfully managed to finish the data collection process in a stipulated time of three weeks. Data collection for this study took place in the northern and central regions in Namibia during September 2010. Data were collected from a sample of 1094 junior secondary schools learners since the larger the sample size, the more representative of the target population it is.

The mathematic teachers in schools assisted in selecting the three grades from each school that participated in the study, whereby one class per grade level at a selected school completed the questionnaire. The sample of this study embodied a logic of discovery of information and it generated hypothesis to answer the research questions of the present study.

The percentage in the Table 4 illustrates that the number of participants were more or less the same in all ten schools, with a range of only three percent. This satisfactory response rate can be attributed to the fact that the purpose of the study was well clarified to all participants. Another reason of satisfactory response rate could be the fact that, I personally administered and managed the questionnaires in all schools, which entailed briefing learners about the filling in of the questionnaires. The briefing of learners was done to ensure that all grade eight to ten learners understood the guidelines and the nature of each question. The demographic data of learners sampled across grades 8 to 10 is shown in a frequency Table 5.

The present data was collected from 466 boys and 627 girls as indicated in Table 5 above. Only one response is recorded as invalid in terms of the participant who did not indicate his/her gender but has completed the questionnaire. As mentioned before, data were collected from schools in urban and semi-urban areas. A brief description of what composed urban and semi-urban groups is discussed below.

3.5.1 Urban group

From the total number of learners who participated in this study, 48.5% representing 531 of the total number of participants (1094) in this study were learners coming from five (5) schools in Khomas region which is an urban area. From the knowledge of experience acquired during my teaching years, the financial situation of most families in the urban areas can be represented as a mixture of middle to high class. Most families in this group have Internet access. Along with this, the level of the parents' education ranges from medium to highly literate; hence the parents' enthusiasm for their children's education is also high.

3.5.2 Semi-urban group

This survey used 563 learners from five (5) schools situated in Oshana region which is a semi-urban area and constitutes 51.5% of the total number of participants. Different from the urban group, few families in semi-urban group have Internet access. The financial status of these families can be taken as middle class. Most learners' parents in this group prefer that their children live in a semi-urban rather than rural area and most of them aspire to send their children to university for further studies.

3.6 Ethical Considerations

In this study, research ethics and principles were complied with. By this is meant that, proper authority of the schools were consulted, informed and that the approved permission was obtained. Written correspondences requesting for permission to conduct the research in two regions were forwarded to the Permanent Secretary in the Ministry of Education as well as to the Regional Directors of education of Oshana and Khomas regions in Namibia.

For the purpose of clarification, the correspondences forwarded to school principals, Directors of education and the ministry highlighted the nature of study, the background to the study and the aim of the research. The Namibian ministry of education and the directors of education in the Oshana and Khomas regions granted written permission to undertake this study. The purpose of the study was orally explained to the school principals who helped with the planning strategy for the administration of questionnaires. Participants were assured that their personal information would be kept confidential and would not be made available to any person not directly involved in the study.

By accepting and maintaining the responsibilities of anonymity and confidentiality, learners did not write their names on the questionnaires and no identification was attached to any school. Anonymity and confidentiality was exercised to uphold research ethics before, during and after the conducting of questionnaires. Furthermore, participation was voluntary and learners could withdraw any time during the process. Problems related to time tabling and schedules were discussed and addressed by the researcher and school authorities. It was decided that about twenty (20) to thirty (30) minutes per class would be needed to complete the questionnaires. The following section discusses the data analysis procedures.

3.7 Data Analysis Procedures

The skills required of researchers are, as Cohen and Ball (1990, p. 178) note, "the ability to step back and critically analyse the situation and results, to recognize and avoid bias and to think abstractly". Therefore, before data was analyzed it needed to be suitably prepared and organized. For data analysis purpose of this study, the questionnaires were numbered from 1 to 1094 and the schools were coded alphabetically from A to J, as indicated in Table 4, which represents school one to ten respectively. The coding was done for "identification and classification" purposes of persons and items (Burton & Bartlett, 2009, p. 101). The responses were first captured in an Excel spreadsheet for clean-up prior to analysis. Data were analysed using the WINSTEPS software (Linacre, 2008) of the Rasch model based on item response theory. Linacre and Wright (2006, p. 1) state that Rasch analysis is a method for obtaining objective, fundamental, linear measures which are qualified by standard errors and quality-control fit statistics from stochastic observations of ordered category responses.

Furthermore, the Rasch model is a probabilistic model which explains a person's level of endorsing items, whereby dealing with a latent trait is predicted by the person's endorsement on the scale (Julie, Holtman & Mbekwa, 2011, p. 13). The scale is the measurement that involves judgment or subjective ratings.

According to Linacre (2011, Online), rating scale is a format for observing responses wherein the categories increase in the level of the variable they define and this increase is uniform for all agents of measurement. It is stated by Long (2009, p. 34) that, the Rasch model is one of the psychometric models useful for analysing ordinal data which are not directly measurable and it falls under statistics. Furthermore, Julie, Holtman and Mbekwa (2010, p. 2) assert that rating scales measure latent traits or constructs. The constructs being measured are not directly observable for example the measurement of interests and preferences that this study aimed for. The questionnaire used consists of a set of items and the respondents were requested to express their level of agreement with each item on some hierarchically ordered response scale, the Likert scale. Therefore, Rasch model was taken to be ideal for this study as the data obtained is viable for the rating scale.

This study essentially dealt with ordinal data based on learners' interest of particular contextual issues which lies within the affective domain in which this study is situated. The nature of data in this study were of ordinal scales whereby items were rated/ranked in the order of "*very high*", "*high*", "*low*" and "*very low*" with scores of 4, 3, 2 and 1 assigned respectively. According to Goulding (1992, p. 103), ordinal scales distinguish order but nothing can be said about how much larger one item is than another but simply that it is larger.

The corresponding numbers were used to make comparisons between groups based on the assumption that there is an equal interval between each of these numbers. That is, that the gap in learners' mathematical interest indicated by the interval between 1 and 2 is the same as the gap in interests at that is indicated by the interval between a 2 and a 3 etc. The Rasch model and the aligned Winsteps software have enabled finer degrees of understanding of the real-life situations learners prefer to use in mathematics.

The Rasch model is used in this study to transform raw data into abstract, equal interval scales. Equality of interval is said to be achieved through "log transformations of raw data odds" (Bond &Fox, 2001, p. 10). An obvious advantage of Rasch model is its ability to calculate person and item measures on a linear scale. Rating scales of the kind used in this study ignored the fact that the response categories are not necessarily linear in the sense that the distances between subsequent responses are not equal. Rasch procedures solve this problem by transforming the data so that the linearity issue is addressed.

Julie and Holtman (2008, pp. 382-383) state that, in Rasch modelling, a model is not sought to fit the obtained data, rather, the model is taken as ideal and the quest is to determined by how closely the data fit the Rasch procedures. Various statistics are reported when Rasch analysis is used and for this project, these statistics were obtained by using the WINSTEPS programme of computer software (Version 3. 65. 0) (Linacre, 2008). On the Rasch model scale, items and subjects were assigned scores on the same metric and informative visuals were generated in order to compare the items and subjects.

This study used the Differential Item Functioning (DIF) which is a statistical procedure for Rasch model which organise items in the same order of endorsement for various sub-groups such as boys and girls (Boone & Rogan, 2005, p. 28). DIF is an important criterion to ascertain that on a measuring scale the items should not function differentially for different categories of participants comprising the sample. This is clarified by Wright (1977, p. 105) that, any item can be analyzed for bias with respect to culture, grades and gender of persons by calculating a regression of its residuals on indicators of these background variables. The response scale in this study contained more than one category, which allowed for the making of judgments on the level of endorsement that each respondent and the entire cohort gave to the item or the scale. The data of the present study were subjected to rating scales, which is a format for observing responses wherein the categories increase in the level of the variable they define, and this increase was uniform for all agents of measurement.

In a Rasch Model analysis of rating scale data, an attitudinal trait, for example interest of persons was estimated in logits (logarithmic units). Linacre (2011, Online) defines logit as the unit of measure used by Rasch for calibrating items and measuring persons. A logit is the logarithmic odds of a person affirming that statements of attitudes apply to himself/herself, and for all persons, the logit is the common unit of quantification. Therefore, in this study the Rasch procedures reported their outcomes in logits derived from the conversion of a raw score of items and persons. Long (2009, p. 35) states that a feature of the Rasch model permits the discovery and amplification of item anomalies, which are inconsistent with the general expectations of the instrument. The Winsteps software that is used in this study provides a misfit index.

Fit statistics is a summary of the discrepancies between what is observed and what we expect to observe. They (fit statistics) are used to identify persons and items that behave oddly or peculiar. It is further stated by Long (2009, p. 35) that, an important aspect of this exercise of fit statistics is to flag problematic persons; those which responded in inconsistent ways for whatever reason.

The researcher is required to further investigate (*post-hoc*) any particular item shown to be misfitting, and if necessary eliminate the item, while at the same time identify a plausible explanation of the item misfit in terms of its own characteristics. Therefore, this study used fit statistics to identify inconsistent or unusual response patterns on the part of learners, and then remove that person entirely. Relations between the items and persons were investigated among the endorsement dimensions through the analysis of response patterns. The issues of validity and reliability are discussed in the next section.

3.8 Issues of validity and reliability

Messick (1989, p. 6) defines validity as (…) always referring to the degree to which empirical evidences and theoretical rationales support the adequacy and appropriateness of interpretations and actions based on endorsement of items. Similarly, Bond (2003, p. 179) sees validity as a core of any form of assessment that is trustworthy and accurate. This study maintained validity by ensuring that data was obtained by using most suitable methods. This follows that, the questionnaire used in this study is derived from "theoretical bases and practical observations, reliability coefficients and various measures undertaken to ensure construct validity" (Julie, Holtman & Mbekwa, 2011, p. 2).

According to Neuman (2003, p. 120), an instrument is seen as being reliable when it can be used by a number of different researchers under stable conditions, with consistent results and the results not varying. Therefore, reliability in this study reflects consistency and replicability over time as the questionnaire used was sourced from existing literature and has been used by previous ROSME researchers in determining learners' interests in contextual issues. This was highlighted in the responses produced by learners that were consistent with other existing research.

This study used the Rasch model to analyse learners' and items' endorsement and calculate separate reliabilities. Thus, allowing for more rigorous and thorough analysis of the data and instrument itself. With Rasch analysis, the item reliability index was examined whereby the item and person separation reliabilities were explored. The maps and indices that the Rasch model generates allowed me to use both statistics and visual plots to possibly associate mathematical beliefs, interests and preferences of mathematical contexts, with receptivity to various learning practices, with socio-cultural factors or with other variables such as gender. The Rasch model provides a wide range of techniques to evaluate the functioning of an instrument by carefully investigating items as well as the responses endorsed by participants (Long, 2009, p. 35).

Moreover, Rasch analysis provides two sets of general guidelines to help the researcher to determine the validity of a set of measures. Firstly, the Rasch model provides estimates for each item and each individual separately. These tell the researcher the relative value of every participant responses and item endorsement estimates. A second way is through the examination of item representation in the questionnaire (Bond & Fox, 2001, p. 8).

The learners' questionnaire used in this study satisfies the aforementioned sets of guidelines because it was subjected to regular changes and improvement by the Relevance of School Mathematics Education (ROSME) project team who made it possible to construct a well thought through questionnaire and reduced it to twenty-three items. The items deal with a large variety of contextual situations and issues which could be dealt with in mathematical literacy and mathematics aiming to address the issue of validity. Therefore, the questionnaire used in this study contains items which elicit reliable information about the learners' mathematical interests and preferences of real-life contexts. As a researcher, I made a point of being at the schools on time to give guidance and to clarify each item, made sure that uncertainty and the lack of understanding were to a large extent eliminated.

3.9 Summary and Conclusion

This chapter dealt with survey research as an appropriate design for this study. All relevant research design procedures like the instrument, sampling, data collection, data analysis procedures and the issues of ethics, validity and reliability are discussed. Data were collected from ten schools comprising 1094 Namibian learners from grades 8 to 10. Of these, 629 were girls and 465 were boys. Learners came from different socio-economic environments. I used Rasch procedures to analyze data and to rank the 23 items into order of the learners' preferred contexts. The nature of this study, with its ordinal data, required analysis to be done via nonparametric procedures using the Winsteps programme. Chapter 4 follows and it presents the data analysis, interprets and discusses the main research findings.

CHAPTER 4

FINDINGS AND INTERPRETATIONS OF RESULTS

4.1 Introduction

In this chapter, the results of the analysed data from learners' responses are presented and discussed. Rasch procedures were employed to inform answering of questions about the attributes of learners' mathematical interests and preferences. The analysis presented here however will remain at the level of quantitative analysis, with empirical support provided by the survey design. Data were collected using the ROSMEII questionnaire which consists of 23 items and the learners' responses were first captured in the excel spread sheet as described in chapter 3 (Section 3.6).

Findings resulting from theoretical and empirical analyses of this study gave rise to some insights of considerable significance to our understanding of processes and outcomes of mathematical learning and for the ways in which mathematics may, or may not be learnt. This study was conducted against the background of a concern about learners' voice that is usually absent in the mathematics curriculum making processes. Descriptive statistical methods were used in this study in the form of charts, graphs, percentages, averages etc. to present information diagrammatically and then a discussion of the findings as follows.

4.2 Overall rank ordering of the items

In a useful ranking scale of items, the construct under discussion should form a hierarchy so that it is possible to conclude which of the items respondents would find easy and which they would find difficult to endorse.

With Rasch modelling, three values can be determined to ascertain the hierarchical property of a scale: the measure of an item, the infit mean square and the outfit mean square values (Boone & Rogan, 2005, p. 28). The quantitative approach based on the aforementioned values was used to establish a total score assigned to each item, the higher numbers indicate greater interest. The measure of infit and outfit mean square values were used in this study to generate the hierarchy of items as endorsed by learners. A high item difficulty means low levels of agreement with the item. The items are in increasing statistical order of context preference as endorsed by learners, with the least preferred items on top and the most preferred at the bottom the Table 8. It can be observed from Table 8 that the five highest ranked items are: C17 (managing personal and business financial affairs), C7 (health matters such as the state of health of a person, the amount of medicine a sick person must take), C4 (secret codes such as pin numbers used for withdrawing money from an ATM), C23 (construction and engineering) and C6 (government financial matters, such as inflation and taxes).

Table 8. *Item Statistics- Measure Order*

Item	*Total Score*	*Count*	*Measure*	*Infit Mean Square*	*Outfit Mean Square*
C1	2129	1087	0.81	1.11	1.12
C14	2295	1072	0.58	0.96	0.94
C2	2360	1076	0.56	1.06	1.07
C13	2437	1087	0.46	0.94	0.95
C15	2468	1086	0.43	0.95	0.95

C22	2532	1090	0.38	0.98	0.97
C5	2593	1071	0.31	1.05	1.06
C11	2588	1074	0.29	0.91	0.91
C12	2798	1074	0.11	0.98	0.97
C21	2860	1080	0.05	0.96	0.94
C3	2771	1054	0.04	1.02	1.02
C20	2960	1088	0.04	0.97	0.97
C19	2921	1084	0.01	0.96	0.96
C18	3044	1088	-0.16	0.97	0.96
C16	3274	1087	-0.30	0.88	0.87
C8	3197	1089	-0.32	0.97	0.97
C10	3316	1086	-0.33	0.94	0.95
C9	3292	1080	-0.41	1.02	1.03
C6	3238	1079	-0.42	1.20	1.21
C23	3473	1092	-0.44	1.10	1.14
C4	3373	1079	-0.46	1.09	1.10
C7	3472	1084	-0.55	1.02	1.01
C17	3565	1086	-0.68	1.08	1.09
MEAN	2911.1	1081.4	0.00	1.00	1.01
S.D.	418.1	8.4	0.41	0.07	0.08

The five lowest ranked items are: C1 (lotteries and gambling), C14 (national and international politics), C2 (cultural products such as the basket decorations made by Oshiwambo women), C13 (all kinds of pop music) and C15 (dancing such as rave, disco and hip-hop). The discussion of least and most preferred items will be given in chapter 5.

In Rasch measurement, we use fit statistics to help us detect the discrepancies between the Rasch model prescriptions and the data we have collected in practice. Boone and Rogan (2005, p. 29) assert that, if all the mean square (infit and outfit) are in the acceptable range of 0.5 and 1.5, then there is evidence that none of the items are significantly problematic. The infit and outfit mean squares of all items used in this study falls under the Rasch model's mean square acceptable range as it can be observed from Table 8 above. The results of the infit and outfit mean squares are indicative of the ROSME instrument's ability to ascertain the contextual situations that learners prefer to deal with in mathematics. A clear and simultaneous person and items level of endorsement is illustrated on the person-item map.

4.3 Person-item map

The person-item map is another component of Winsteps procedures that shows the inadequacy of treating raw scores of endorsement ability and difficulty directly as measurement scales (Bond & Fox, 2001, p. 17). A person-item map is a single difficulty/ability continuum which explains the patterns of item/person endorsements. To illustrate the point, the ability measures have been taken from Table 8 and their locations plotted along a continuum to see how the items and persons disperse as it is illustrated on Figure 1.

The idea of measuring a single variable is depicted with a map of person-items which according to Linacre (2008, p. 30) provides an indication of informativeness of the measures on the same scale. The logit scale is used as the interval scale in which the unit between the locations on the person-item map have a consistent value or meaning (Bond & Fox, 2001, p. 30). Therefore, each item and person is located along the logit scale according to its estimated value, for example, more positive persons (with higher interest) endorse more.

The spread of items and learners along the whole scale indicates that the questionnaire functions well, hence information on the number of learners at all levels can be obtained. The Rasch model sets 50% as the probability of endorsement for any person and an item located at the same level on the item-person logit scale and the item mean is set at zero. For the purposes of this study, it suffices to say that a learner at a particular point on the scale can be expected to have a 50% chance of endorsing items allocated at the same level. Furthermore, learners have a less than 50% chance of endorsing items above and a more than 50% chance of endorsing items below.

The map in Figure 1 illustrates how 1094 learners responded to 23 items in informative visuals based on their preferences for real-life situations to be used in Mathematical Literacy. The illustration on the item-person map shows that the researcher can clearly identify "(a) which items are more difficult to endorse than others and which persons agrees more than others; (b) gaps along the continuum where items are missing; and (c) how well the endorsement difficulties of the items are matched to the interest level of the sample" Linacre (2008, p. 31).

Figure 1. *Person-item Map*

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 0                  #####  +M C19    C20    C3
                  .######  |
                   .#####  |  C18
                     .### S|
                     .###  |  C10    C16    C8
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: 9 learners

. : at most 8 learners

M : the location of the mean

S : one sample Standard Deviation from the mean

T : two sample Standard Deviations from the mean

The items are plotted along a single dimension according to their difficulty, for example, Item C1 is the hardest to endorse, whereas items C23, C6 and C9 are at the same difficulty level of endorsement. Julie and Holtman (2008) indicate that, context preference items which share the same location on a logit scale with at least one other item indicates a redundancy of items, which points to the replacement of some items on that location by just one of the items without having an effect on the reliability and validity of the instrument.

However, depending on the latent trait under consideration in this study is such that “items might have a similar location on the scale, but be conceptually different in that they refer to distinctly different contexts” (Julie & Holtman, 2008, p. 387). Therefore, the results in this study indicate that items that shared the same location on the item-map scale are of distinct contexts. The examples which can be observed are: C19 (responding to emergencies and disasters), C20 (the spread and decline of epidemics such as AIDS, tuberculosis and cholera) and C3 (the latest designer clothes). These three items are conceptually different in the sense that emergencies, diseases and designer clothes cannot be said to be in the same mathematical conceptual category.

In the analysis of this study, comparisons across the three grades were made to find whether there were distinct differences in the mathematical contexts preferred by the learners in the three grades. This was done without overlooking the differential item functioning for gender differences in contextual interests of learners as discussed next.

4.4 Gender Differential item functioning (DIF)

Differential Item Functioning (DIF) reports on whether there are significant differences for the endorsement of the items by sub-groups of the sample (Boone & Rogan, 2005, p. 28). DIF produces detailed tables and plots of uniform and non-uniform size and significance. It is desirable for items to appear in the same order of endorsement for various sub-groups of a sample, such as males and females. It is stated by Boone & Rogan (2005, p. 28) that, existence of DIF effect means that an item is easier to be endorsed by a group of respondents compared to another group. Given that for this study the participants were learners of different genders, the items should not function differentially for females and males.

For gender DIF some respondents were discarded from the data set before analysis was effected because the participants did not indicate their gender. This makes the discarded persons to be "inadequate and not useful discriminator for the sequence under investigation" (Bond & Fox, 2001, p. 13). Analysis of differential item functioning along gender lines was conducted and the results are reported in Table 9. As stated earlier, DIF contrast is the difference in endorsement difficulty of the item between the measures for females and males (female measure – male measure).

Linacre (2008, p. 266) states that the DIF contrast should be at least 0.5 logits for DIF to be noticeable. The DIF contrast for item C2 did not meet this criterion because it exceeded 0.5 logit, showing that this item is easier to endorse for girls than it is for boys. Rasch analysis also produces the excel plot as shown on Figure 2.

The excel plot illustrates a clear pattern of item as endorsed by learners and is highly informative to show the DIF for the construct we are purporting to measure. Linacre (2011, p. 8) clarifies that it usually makes more sense to look at the excel plots first, as they tell us where to look in the numerical tables for the interesting numbers.

Figure 2. *Person DIF Excel plot for females and males*

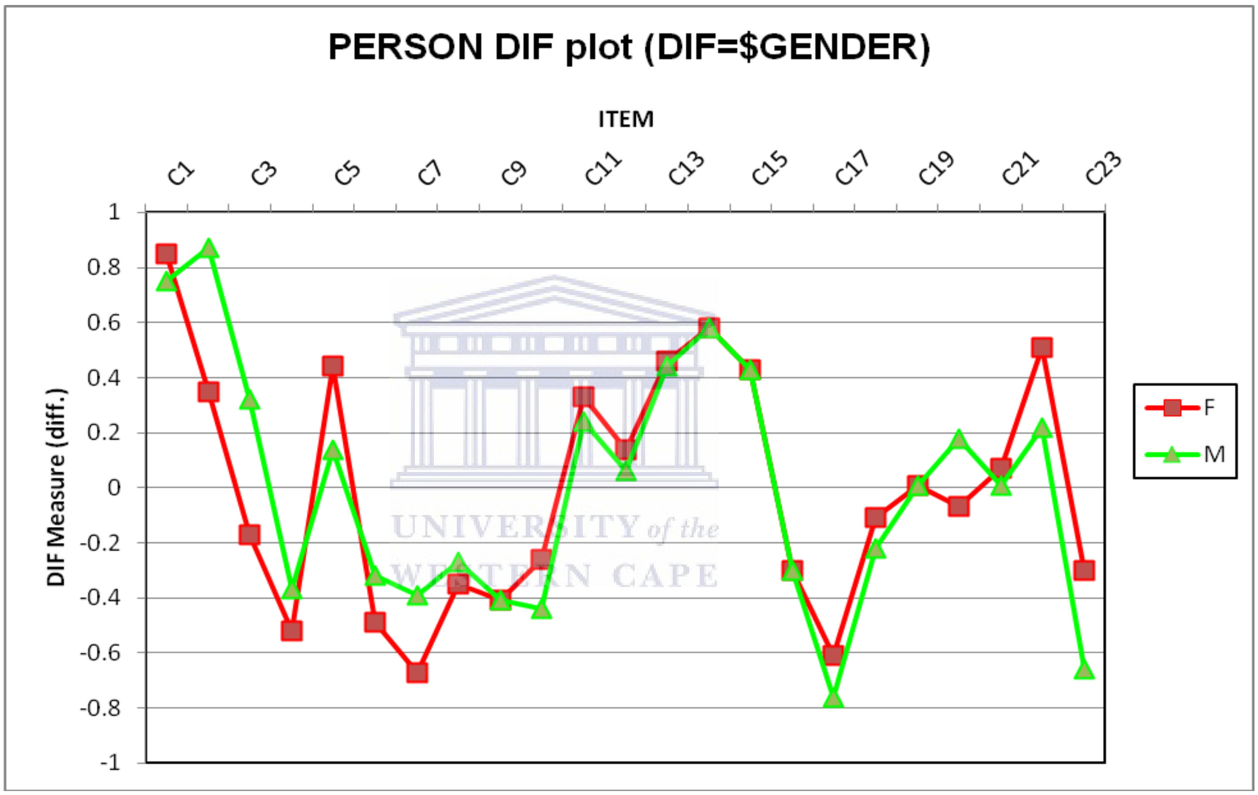

Table 9. *Gender Differential Item Functioning class specification*

Person Class	*DIF Measure*	*DIF S.E*	*Person Class*	*DIF Measure*	*DIF S.E*	*DIF Contrast*	*t*	*Item*
F	0.85	0.05	*M*	0.76	0.05	0.09	1.28	C1
F	**0.35**	**0.04**	***M***	**0.87**	**0.06**	**-0.52**	**-7.29**	**C2**
F	0.17	0.04	*M*	0.32	0.05	-0.49	-7.18	C3
F	- 0.52	0.05	*M*	-0.37	0.05	-0.16	-2.14	C4

F	0.44	0.04	*M*	0.14	0.05	0.31	4.57	C5
F	-0.49	0.05	*M*	-0.32	0.05	-0.17	-2.35	C6
F	-0.67	0.05	*M*	-0.39	0.05	-0.28	-3.88	C7
F	-0.35	0.05	*M*	-0.27	0.05	-0.07	-1.05	C8
F	-0.41	0.05	*M*	-0.41	0.05	0.00	0.00	C9
F	-0.26	0.04	*M*	-0.44	0.05	0.18	2.72	C10
F	0.33	0.04	*M*	0.24	0.05	0.08	1.23	C11
F	0.14	0.04	*M*	0.06	0.05	0.08	1.17	C12
F	0.46	0.04	*M*	0.44	0.05	0.02	0.38	C13
F	0.58	0.04	*M*	0.58	0.05	0.00	0.00	C14
F	0.43	0.04	*M*	0.43	0.04	0.00	0.00	C15
F	-0.30	0.04	*M*	-0.30	0.05	0.00	0.00	C16
F	-0.61	0.05	*M*	-0.76	0.06	0.15	1.87	C17
F	-0.11	0.04	*M*	-0.22	0.05	0.12	1.87	C18
F	0.01	0.04	*M*	0.01	0.05	0.00	0.00	C19
F	-0.07	0.04	*M*	0.18	0.05	-0.25	-4.10	C20
F	0.07	0.04	*M*	0.01	0.05	0.06	0.88	C21
F	0.51	0.04	*M*	0.22	0.04	0.29	4.89	C22
F	-0.30	0.04	*M*	-0.66	0.06	0.36	4.89	C23

The difficulty of each item for each group is estimated, while holding constant all the other item difficulty and person ability measures.

4.5 Grades Differential item functioning (DIF)

This analysis rendered that none of the items were problematic in terms of DIF effect among the three grades. Figure 3 below is the excel plot that shows how the DIF contrast for the items satisfied the differential item functioning criterion for the three grades.

Figure 3. *Person DIF Excel plot for grades 8, 9 and 10*

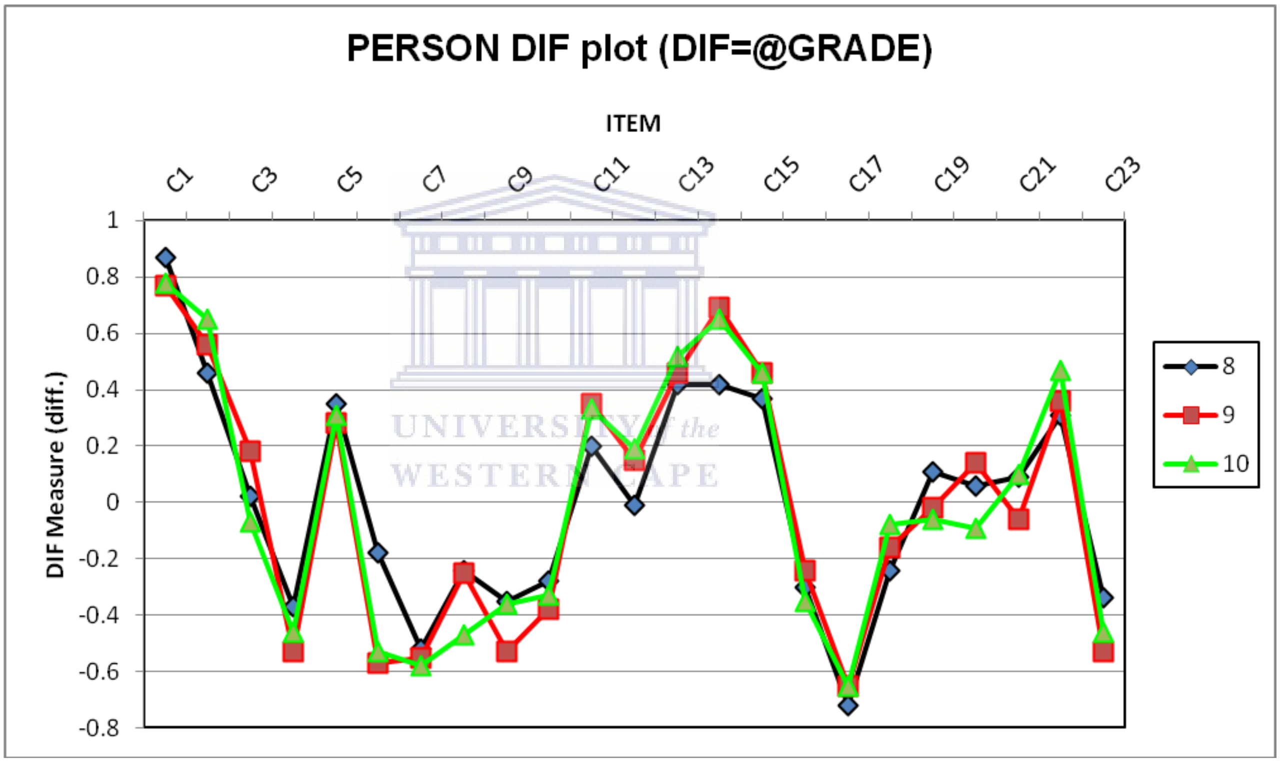

Table 10. *Grades Differential Item Functioning class specification* **(continue overleaf)**

Person Class	*DIF Measure*	*DIF S.E*	*Person Class*	*DIF Measure*	*DIF S.E*	*DIF Contrast*	*t*
8	0.87	0.06	9	0.77	0.06	0.1	1.2
8	0.87	0.06	10	0.78	0.06	0.09	1.09
9	0.77	0.06	10	0.78	0.06	-0.01	-0.13
8	0.46	0.06	9	0.56	0.06	-0.1	-1.22
8	0.46	0.06	10	0.65	0.06	-0.19	-2.34
9	0.56	0.06	10	0.65	0.06	-0.09	-1.07
8	0.02	0.06	9	0.18	0.06	-0.16	-1.96
8	0.02	0.06	10	-0.07	0.06	0.08	1
9	0.18	0.06	10	-0.07	0.06	0.25	2.91
8	-0.37	0.06	9	-0.53	0.06	0.16	1.78
8	-0.37	0.06	10	-0.46	0.06	0.08	0.97
9	-0.53	0.06	10	-0.46	0.06	-0.07	-0.79
8	0.35	0.06	9	0.28	0.06	0.08	0.94
8	0.35	0.06	10	0.31	0.06	0.04	0.54
9	0.28	0.06	10	0.31	0.06	-0.03	-0.4
8	-0.18	0.06	9	-0.57	0.06	0.39	4.49
8	-0.18	0.06	10	-0.53	0.06	0.35	4.06
9	-0.57	0.06	10	-0.53	0.06	-0.04	-0.44
8	-0.52	0.06	9	-0.55	0.06	0.03	0.37
8	-0.52	0.06	10	-0.58	0.06	0.06	0.66
9	-0.55	0.06	10	-0.58	0.06	0.03	0.28
8	-0.24	0.06	9	-0.25	0.06	0.01	0.1
8	-0.24	0.06	10	-0.47	0.06	0.22	2.64
9	-0.25	0.06	10	-0.47	0.06	0.22	2.49

8	-0.35	0.06	9	-0.53	0.06	0.18	2.1
8	-0.35	0.06	10	-0.36	0.06	0.01	0.18
9	-0.53	0.06	10	-0.36	0.06	-0.17	-1.9
8	-0.28	0.05	9	-0.38	0.06	0.1	1.26
8	-0.28	0.05	10	-0.33	0.06	0.06	0.74
9	-0.38	0.06	10	-0.33	0.06	-0.04	-0.51
8	0.2	0.06	9	0.35	0.06	-0.15	-1.83
8	0.2	0.06	10	0.33	0.06	-0.13	-1.64
9	0.35	0.06	10	0.33	0.06	0.02	0.22
8	-0.01	0.06	9	0.15	0.06	-0.16	-2.01
8	-0.01	0.06	10	0.19	0.06	-0.2	-2.6
9	0.15	0.06	10	0.19	0.06	-0.04	-0.55
8	0.42	0.05	9	0.46	0.05	-0.04	-0.6
8	0.42	0.05	10	0.52	0.05	-0.1	-1.41
9	0.46	0.05	10	0.52	0.05	-0.06	-0.78
8	0.42	0.05	9	0.69	0.06	-0.27	-3.53
8	0.42	0.05	10	0.65	0.05	-0.24	-3.14
9	0.69	0.06	10	0.65	0.05	0.04	0.46
8	0.37	0.05	9	0.46	0.05	-0.09	-1.31
8	0.37	0.05	10	0.46	0.05	-0.09	-1.34
9	0.46	0.05	10	0.46	0.05	0	-0.01
8	-0.3	0.06	9	-0.24	0.06	-0.07	-0.82
8	-0.3	0.06	10	-0.35	0.06	0.04	0.53
9	-0.24	0.06	10	-0.35	0.06	0.11	1.34
8	-0.72	0.07	9	-0.65	0.07	-0.07	-0.76
8	-0.72	0.07	10	-0.65	0.07	-0.08	-0.82
9	-0.65	0.07	10	-0.65	0.07	-0.01	-0.06

8	-0.24	0.06	9	-0.16	0.06	-0.09	-1.04
8	-0.24	0.06	10	-0.08	0.06	-0.16	-1.97
9	-0.16	0.06	10	-0.08	0.06	-0.07	-0.91
8	0.11	0.05	9	-0.02	0.06	0.13	1.64
8	0.11	0.05	10	-0.06	0.06	0.17	2.24
9	-0.02	0.06	10	-0.06	0.06	0.04	0.57
8	0.06	0.05	9	0.14	0.05	-0.08	-1.15
8	0.06	0.05	10	-0.09	0.05	0.15	2.02
9	0.14	0.05	10	-0.09	0.05	0.23	3.12
8	0.09	0.05	9	-0.06	0.06	0.14	1.83
8	0.09	0.05	10	0.1	0.06	-0.01	-0.18
9	-0.06	0.06	10	0.1	0.06	-0.16	-1.99
8	0.31	0.05	9	0.36	0.05	-0.05	-0.63
8	0.31	0.05	10	0.47	0.05	-0.16	-2.3
9	0.36	0.05	10	0.47	0.05	-0.12	-1.62
8	-0.34	0.05	9	-0.53	0.06	0.19	2.36
8	-0.34	0.05	10	-0.46	0.06	0.13	1.59
9	-0.53	0.06	10	-0.46	0.06	-0.06	-0.76

It can be observed that none of the reported probabilities for the items were more than 0.5 and hence DIF for Namibian learners in grades eight, nine and ten was statistically significant for all the items of the scale. The learners' responses did not differ from the Rasch model's expectations as it can be observed in the DIF contrast column of Table10 above.

4.6 Summary and Conclusion

This chapter dealt with the quantitative analysis of the data by firstly identifying the five highest ranked items and the five lowest ranked items from grade 8, 9 and 10 learners. The order of items as endorsed by males and females and across the three grades was analysed and discussed. This follows that, differences and similarities between the subgroups have been detected, presented and reported. From the overall findings of mathematical contexts preferred by grades eight to ten learners, there seemed to be no significant differences. However, the findings generating from this study highlighted the focus and perspectives of individuals that can influence the learners' growing interest in the learning of mathematics.

The results of this study further indicated the real-life situations which learners most and least preferred to be included in Mathematical Literacy, "providing useful information for policy-makers and textbook authors on contextual situations to be included in learning materials" (Julie, Holtman & Mbekwa, 2011: 11). It is hypothesised that if the contextual interests are included in mathematical learning and teaching materials, it will enable learners, regardless of their gender, age or grade to distinguish, appreciate and understand the role of mathematics in the society; as well as to identify the influences such contexts have on their mathematical learning. The grade eight to ten learners in this study expressed an interest in mathematical contexts and it shows that learners have some insights of crucial global and national issues that have an impact to our rapidly changing world. This is shown by the contexts that learners have opted for, for example health, distribution of wealth, connectivity and technological explosion which all affect quality of life.

The present study emphasised the importance of the affective domain, specifically, the contextual issues learners associate with quality mathematics learning. Tracking of mathematical contexts preferred by learners is important for informing decision-makers and learning resource developers of relevant real-life situations to include in such materials. It can therefore be argued that, mathematical education will become broader if the consideration of learners' preferred contexts is to be enforced. In addition, Namibia can partake in sharing mathematical contexts research issues by following the examples of other countries that advent and incorporate mathematical literacy in the school curriculum.

This chapter focused on the findings and discussion of the issues inherent in real life contexts in mathematics. I attempted to make a link between the contextual issues that learners see as mathematical relevant and their affective notion. The last chapter follows and will focus on key findings and conclusions that can be drawn from this study as well as proposed recommendations.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

The study investigated the contexts preferred by learners of mathematics in their individual grades which comprised grade 8, 9 and 10 learners. Results in response to the research question were given in the previous chapter. The assumption is that incorporating the contexts that learners prefer in their experiences with mathematics would contribute towards improving mathematical learning. The learners were drawn from the urban and semi-urban areas in Namibia. The discussion of this study was limited to the scope of research questions, which were:

1. What are the contexts Namibian learners most prefer to deal with in mathematics?
2. What are the contexts Namibian learners least prefer to deal with in mathematics?
3. Are there gender differences in the context which learners prefer?
4. Are there differences in the context preferred between the three grades?

A summary of the answers to those questions will be given in this chapter. The limitations of this study will also be stated and recommendations made for further research.

5.2 Overall Summary

In order to draw useful evidence that answers my research questions, the data were analysed by the Winsteps computer program (version 3. 65. 0) of the Rasch model to obtain the mean ranking. According to Bond and Fox (2001, p. xviii), output from the Rasch analysis informs the researcher of the empirical hierarchy of items.

The hierarchical order of the items as given in Table 9 provided an indication of five most preferred and five least favoured contexts for learning mathematics, as discussed below.

5.2.1 Five Highest Ranked Items

The five highest ranked items are: C17 (managing personal and business financial affairs), C7 (health matters such as the state of health of a person, the amount of medicine a sick person must take), C4 (secret codes such as pin numbers used for withdrawing money from an ATM), C23 (construction and engineering) and C6 (government financial matters, such as inflation and taxes). These most preferred contexts reflect a wide range of real life situations that many people consider to have an impact on their daily lives. This highlights that learners are aware of the factors that influence people' s day-to-day living, for instance national economic and finances, health issues, information and technology as well as high status professional careers.

Brown (2004, p. 28) views mathematical learning in the modern world as underpinned by the belief that what the learners do is based on their past experiences, their interests and by interacting with the world around them. This view is in line with the findings of this study in the sense of uncovering the contexts that learners prefer to use in their mathematical learning based on their real-life situations. Thus, with much change in social and economical structures of the society, the global call is on mathematics curriculum developers as well as mathematics education advisory and inspection services to consider the contextual issues that learners prefer to deal with in mathematics.

The indication is that the Namibian grade eight to ten learners are aware of the variety of activities that contribute to nation building. The learners' most preferred contexts point us to the notion that, we live in an age of educational accountability which calls for learners to take part in the nature of their mathematical learning. The learners' participation in the production of learning materials will enable them to accomplish an optimal learning in mathematics in accordance with their contextual interests, preferences, needs as well as highlighting the mathematical capacity and potential of different learners in different communities.

The educational paradigm envisioned for the Namibian nation call for the involvement of all stakeholders, including learners, in order to secure ownership of the mathematical curriculum. Therefore, it is important for all the stakeholders in mathematics education to notice, point out and consider that the changes in societal values seem to bear on the mathematics curriculum. This will only be met and uphold if the learners' voice is given a room in the mathematics curriculum.

However, it is argued by Julie (2007) that, school mathematics cannot be solely driven by the interest of students but given that they do have interests whose incorporation might have positive consequences, a school mathematics curriculum sense where the contextual interests of students, teachers, parents and designers of curriculum and learning resources are to be balanced. This will help educational planners as well as curriculum and resource designers to improve the quality and enhance the relevance of mathematics education through curriculum design and material development which include learners' input.

5.2.2 Five Lowest Ranked Items

The main question attached to all items on the questionnaire was for learners to show their interest in learning about mathematics that involved the indicated items. The five lowest ranked items are: C1 (lotteries and gambling), C14 (national and international politics), C2 (cultural products such as the basket decorations made by Oshiwambo women), C13 (all kinds of pop music) and C15 (dancing such as rave, disco and hip-hop). According to the five least preferred items, learners have shown to have less interests in games of probability that involve money, in political issues, cultural matters and in different types of music. This observation replicates the findings of ROSME studies done in other sub-Saharan countries, whereby learners did not perceive items such as cultural artefacts and gambling as relevant in their mathematical learning.

To this, Holtman *et al*. (2011, p. 128) state that games of chance (e.g. gambling) and activities associated with cultural traditions are often viewed in African society as vices to be stamped out of society and those issues linked to culture are generally regarded by youth as traditional and backward. These attitudes towards gambling and cultural practices expressed by the learners therefore mirror attitudes carried by the wider society in these three countries.

Therefore, in late-developing countries such as South Africa, Swaziland, Zimbabwe (and now Namibia) grade eight to ten learners are aware of the negative consequences of spending money on issues dealing with randomness and recreational activities such as gambling. From my own speculation, young people in Namibia see any activity or instrument of cultural connotation as outdated and old fashioned.

However, we have to be infinitely careful not to jump to conclusions and make false inferences about the processes and outcomes of students' learning of mathematics. This will prevent us from making wrong or simplistic assumptions and conclusions. Hannula (2006, p. 229) draws from the analysis that different mathematical contexts are important in the sense that, it "help generating a pathway into the subject (mathematics) by making connectedness and relevance of mathematics visible during the curriculum reforms." To specify desirable or satisfactory learning of mathematics, including the mathematical competencies, different categories of individuals' contextual interests should considered. However, the benefit of considering the learners' views may uplift the learners' level of mathematical competence and increase enjoyment in mathematics.

5.2.3 Are there gender differences in the context that learners prefer?

Gender-based experiences are one of many influences on the affective issues of children towards mathematical learning. It is also known that the way problems are contextualised and exemplified in mathematics can act as a gender filter. As presented in the previous chapter, differential item functioning (DIF) enabled me to investigate how items on the questionnaire functions in relations to gender dimensions. To examine item bias (DIF), this analysis rendered only one item C2 (cultural products such as the basket decorations made by Oshiwambo women) as problematic with a DIF contrast of -0.52. This implies that item C2 was easier to endorse for female than for male learners, which might have been caused by the words used in the description of an item 'basket decorations made by Oshiwambo women'. The words 'basket decorations' and 'by women' can cause boys to accord the item less endorsement.

This is so, because in the Namibian society it is mostly women who weave baskets and they are the ones who do most decorations. The observation of item C2 DIF contrast does not mean the problematic item should be thrown out immediately as biased against boys; the DIF contrast is near enough to the 0.5 criterion for acceptance, so as not to unduly influence comparisons between boys and girls. According to Long (2009, p. 35-36), Rasch approach requires that the data fits the Rasch model before claims regarding the presence of a latent trait can be considered valid.

The researcher is required to further investigate any particular item shown to be misfitting, and if necessary eliminate the item, while at the same time identify a plausible explanation of the item misfit in terms of its own characteristics. However, item C2 cannot be eliminated, rather, the item may need to be rewritten by dividing the item into two other items, one for boys and one for girls. The low occurrence of DIF contrast points us to the current curriculum placement that gives much encouragement to girls to do mathematics in high school as opposed to the old curriculum. A similar DIF analysis was conducted for the different grades as expounded on in the next section.

5.2.4 Are there differences in the context preferred between the three grades?

The analysis did not render any overall noticeable differential item functioning for the three grades. This is evidence that grades eight to ten learners indicated to have same preference for the mathematical contexts given in the questionnaire. This outcome replicated Cornelissen’s (2008, p. 56) study results, whereby all three grades accord almost similar rankings to items.

Even though item C2 was problematic for gender, Linacre (2011, p. 8) cautions that DIF studies are notorious for producing non-replicable findings and researchers should not immediately throw out the problematic items as biased against some subgroups because next time they may show no bias at all. Moreover, the DIF class specification for grades and gender provided a strong sense that the instrument used in this study represents a unitary latent trait as reference for real-life situations to be used in school.

5.3 Limitations

Due to the geographical vastness of Namibia and lack of financial resources, the scope of the study was narrowed to cover the schools that are in urban and semi-urban areas in Oshana and Khomas educational regions only. The limited magnitude of this study did not allow learners to substantiate their claims on the questionnaire, which could have accord them an opportunity to further clarify their affect towards mathematics and its study. In analysing the data it became apparent that it would have enhanced the results to have had open-ended responses from learners which could have provided reasons for the items they had accorded high preference and those they rated low.

Most of the ROSME studies were undertaken in countries with Mathematical Literacy as an optional subject to pure Mathematics. For instance, the South African education system made Mathematical Literacy a compulsory subject for students who are not doing Mathematics at the Further Education and Training level from 2006.

According to Barnes (2006, p. 4), Mathematical Literacy deals primarily with contexts and there is a huge need for people to apply mathematical knowledge and skills to real life or to mathematise contextual situations. In contrast, Namibian schools only offer Mathematics, which is mainly abstract. However, specific actions such as the inclusion of learners' preferred contexts will enable children to think critically about the use of mathematics in their lives, for social change.

The inclusion of real life issues in mathematics will also guide learners in making decision about social and economic issues that can make them understand as well as appreciate mathematics as encountered in their day-to-day living. It is imperative to recognise that the results of this study only apply to grade eight to ten learners at selected urban and semi-urban schools in Oshana and Khomas regions of Namibia. Hence, no generalization should be made to other learners in other demographic areas. The study provides some recommendations for further research in the field as presented in the next section.

5.4 Recommendations

This study is to be considered as fundamental research conducted in order to secure a foundation for future effective mathematics learning which may lead to desirable learning of mathematics. Firstly, I recommend that, further research should be done in rural areas and in schools of learners with special needs in order to obtain a much more representative picture of the contexts learners would prefer to deal with in mathematics in Namibia. These learners might have different contextual preferences based on their socio-economic backgrounds.

Low endorsement of items and the differential item functioning (DIF) points to areas in need of continuous improvement of the instrument. For example, the analysis renders DIF contrast for item C2 (cultural products such as the basket decorations made by Oshiwambo women), whereby girls find this item easier to endorse than boys. Secondly, this study recommends that item C2 be re-written or rather split into two, with one male-related item and the other to be female-related. Furthermore, some low preferred items such as “mathematics involved in lotteries and gambling, politics, culture, music etc” can also be incorporated in the curriculum to enlighten the learners about the implications of those items. The implications can be, for example, the presence and influence of politics and culture as well as expose the destructiveness of gambling in the society.

Thirdly, in the process of data analysis I discovered the shortcoming in enabling me to better analyse and discuss relationships among items, which call for the need to move beyond a methodology limited to quantitative data and statistical analysis.

Fourthly, in her pilot study, Ngcobo (2009, p. 64) found that “the most common error detected when capturing the data was (learners) skipping an item or circling two numbers on the same item.” This oversight also occurred in the present study of which the recommendation is called for the spaces between items to be adjusted to equal margins to avoid learners skipping questions and circling two numbers on one row.

Finally, Rasch procedure is about analysis to develop quality instruments. The use of DIF in this study is one of the strengths of Rasch model that provided information regarding the instrument at hand and it enables a researcher to find ways of refining it.

This will help to produce or refine a learner quality measurement instrument that could be used in future studies. Since the study revealed that learners have a definite interest for various contexts, the study suggests that the materials and resources developers as well as educators in mathematics should draw on the learners' contextual interest. Furthermore, mathematicians and all stakeholders in processes of enacting mathematical teaching and learning materials need to consider individual learners' mathematical world views that enable one to engage in problem solving of real life situations. This will enable learners to attach their mathematical world views to the natural surroundings as well as to social and technological environments.

The inclusion of learners' preferred contexts in material development may ameliorate the apparent disparities that exist between the intended results of policy implementation and the actual implications of mathematical content in different schools in Namibia. Therefore, the research questions in this study calls on text book writers, mathematics and mathematical literacy teachers who seek to take cognisance of the interest of learners of different gender and coming from various socio-economic environments to use the data and findings to influence their choices of mathematical contexts to be included in mathematics.

5.5 Overall Conclusion

This study contributed to the work of previous researchers on the contexts learners prefer to use in mathematics. The findings revealed the most and least preferred mathematical contexts by grade eight to ten learners in Namibia. Different literatures in line with the current topic indicate that there might be a connection between the contexts preferences and the learners' liking of mathematics.

Furthermore, the findings of this study presented information to direct us that, if we want to teach mathematics with satisfactory or desirable results, there are several matters to be considered, such as the inclusion of learners' preferred contextual issues in material development. The inclusion of learners' preferred contexts in the development of teaching and learning materials and curriculum will enable learners to learn with confidence as well as enhance their mathematical learning based on every day, practical, real-life situations. This will also help learners, regardless of their gender, to develop self-empowerment, sustained motivation, high self-esteem and the power to face life and career challenges.

This study considered the importance of mathematical literacy which entails the individual competencies in using mathematical knowledge of problem-solving in a practical and functional way based on the learners' personal, economic, societal and cultural variables. Mathematical literacy enables learners to develop concepts, procedures and justification that can lead to mathematical resolution, understanding and explanation of the issue at hand.

The findings on preferred and non-preferred contextual variables are relevant to the learners' mathematical well-beings and have important implications for mathematics educators. One implication is that mathematics educators need to be aware of learners' contextual interests when constructing and implementing mathematical policy, curriculum and textbooks. The meaningful contribution from the learners' side in material development can enable teachers, curriculum developers, policy makers and researchers to take corrective action in an environment of partnership with those at the local level such as learners.

Research in the area of quality mathematical learning sheds light on the issues pervading mathematics classrooms and curriculum today. High quality mathematical education impacts children within and beyond the classroom, preparing them for employment, higher education and the challenges of daily life. The general consensus is that something should be done in order to improve the quality of mathematics education in Namibia and ensure that mathematical literacy becomes the key driver leading towards achieving the country's educational goals, especially Vision 2030. The contextual preferences as endorsed by learners inform different stakeholders in mathematical education of different contexts pertaining to young people's mathematical interests. Alternatively, with actions required in order to improve the conditions of mathematical learning in Namibian schools, the present study is designed to inform policy related achievement in connection with contextual factors that learners prefer to use in mathematics.

Contextual factors can be personal, educational, occupational, public or scientific issues that learners can relate their mathematical problems to**.** The results are encouraging and may provide mathematics education with an avenue to consider including contexts preferred by learners in mathematics. It is believed that mathematics embedded in learners' contextual interests can influence improvement in planning and development of mathematical teaching and learning programmes. Thus, the study sought to engage learners' voice in their study of mathematics instead of simply being passive participants. Students are curious, active learners who have individual interests, abilities and needs; they come to classrooms with different knowledge, life experiences and backgrounds that generate a range of attitudes about mathematics and life in general.

The current trend is that more and more occupations require the ability to use, communicate, understand and explain concepts and procedures based on mathematical interests. This study could provide a platform for the voices of learners to be heard and may influence how mathematical practitioners shape their practices to affirm and support learners from different backgrounds and cultures. On this, Donaldson (2009, p. 24) emphasizes that, taking greater account of important information from learners, can help ensure effective learning in mathematics. In conclusion, this study applauds an appreciation of mathematics as a dynamic, changing and relevant discipline that should serve the learners' needs and that of their communities, which will help deepen their (learners') engagement with mathematics.

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APPENDIX **A**

CODE:…………………

RELEVANCE OF SCHOOL MATHEMATICS EDUCATION (ROSME)

September 2010

Things I am interested to learn about in Mathematics

I am:- a female …… a male ….. I am ……. years old

I am in Grade: …………….

Which things would you like to learn about in mathematics? Some possible things are in the list below. Beside each item in the list, make a cross over or next to one of the words or in the box next to the item to say how much you are interested in the issue. Please respond to all the items and choose only one of the words for every item.

There are no correct answers: we want you to tell us what **you** like.

Examples:

If you are a little interested to learn about the mathematics involved in "building houses" then you will make a cross (X) next to or over "low" in the box as shown below.

My interest in learning about mathematics involved in						
CEx1		building houses is	Very high	High	Low **X**	Very low

If you are very interested to learn about the mathematics involved in "painting a car" then you will make a cross (X) next to or over "Very high" in the box as shown below.

My interest in learning about mathematics involved in						
CEx2		painting a car is	Very high **X**	High	Low	Very low

We thank you for your participation.

My interest in learning about mathematics involved in					
C1	lotteries and gambling is	Very high	High	Low	Very low
C2	cultural products such as the basket decorations made by Oshiwambo women is	Very high	High	Low	Very low
C3	the latest designer clothes is	Very high	High	Low	Very low
C4	secret codes such as pin numbers used for withdrawing money from an ATM is	Very high	High	Low	Very low
C5	agricultural matters is	Very high	High	Low	Very low
C6	government financial matters, such as inflation and taxes is	Very high	High	Low	Very low
C7	health matters such as the state of health of a person, the amount of medicine a sick person must take is	Very high	High	Low	Very low
C8	determining the level of development regarding employment, education and poverty of my community is	Very high	High	Low	Very low
C9	being productive with the doing of tasks in a job is	Very high	High	Low	Very low
C10	making computer games and storing music and videos on CD's and I-pods is	Very high	High	Low	Very low
C11	environmental issues and climate change is	Very high	High	Low	Very low
C12	determining the origin and age of the universe is	Very high	High	Low	Very low
C13	all kinds of pop music is	Very high	High	Low	Very low

C14	national and international politics is	Very high	High	Low	Very low
C15	dancing such as rave, disco and hip-hop is	Very high	High	Low	Very low
C16	sending and receiving of electronic messages such as SMS's and e-mails is	Very high	High	Low	Very low
C17	managing personal and business financial affairs is	Very high	High	Low	Very low
C18	recreation, physical exercise, sport activities and competitions is	Very high	High	Low	Very low
C19	responding to emergencies and disasters is	Very high	High	Low	Very low
C20	the spread and decline of epidemics such as AIDS; tuberculosis and cholera is	Very high	High	Low	Very low
C21	planning a journey is	Very high	High	Low	Very low
C22	crime fighting, warfare and military matters is	Very high	High	Low	Very low
C23	construction and engineering	Very high	High	Low	Very low

APPENDIX **B**

Table 6. *Total number of boy and girl learners in each region*

	Urban	*Semi-urban*	*Total*
Total Number of Schools	5	5	10
Total Number of girl learners (%)	305 (48.5%)	324 (51.5%)	629 (100%)
Total Number of boy learners (%)	226 (48.6%)	239 (51.4%)	465 (100%)
Total Number of Learners (%)	531 (48.5%)	563 (51.5%)	1094 (100%)

Table 7. *Total number of learners per grade per region and their median age per grade*

Grade	*Urban*	*Semi-urban*	*Total*	*Percent*	*Median (age)*
Gr. 8	174	205	379	34.64	14.00
Gr. 9	175	179	354	32.36	15.00
Gr. 10	182	179	361	33.00	16.00
Total	531	563	1094	100.00	