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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                  .#####   |T C1
                    .###   |
                ######## S |
                   #####   |   C14     C2
             .###########  |   C13
             .###########  |S  C15     C22
                  ######   |   C5
             .########### M|   C11
              .##########  |
               .#########  |   C12     C21
 0                 #####   +M  C19     C20     C3
                 .######   |
                  .#####   |   C18
                    .### S |
                    .###   |   C10     C16     C8
                     .##   |S  C23     C6      C9
                       #   |   C4
                      .#   |   C7
                       # T |   C17
                       #   |
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                           |
-2                         +
                     <less>|<frequent>            EACH '#' IS 9
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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*

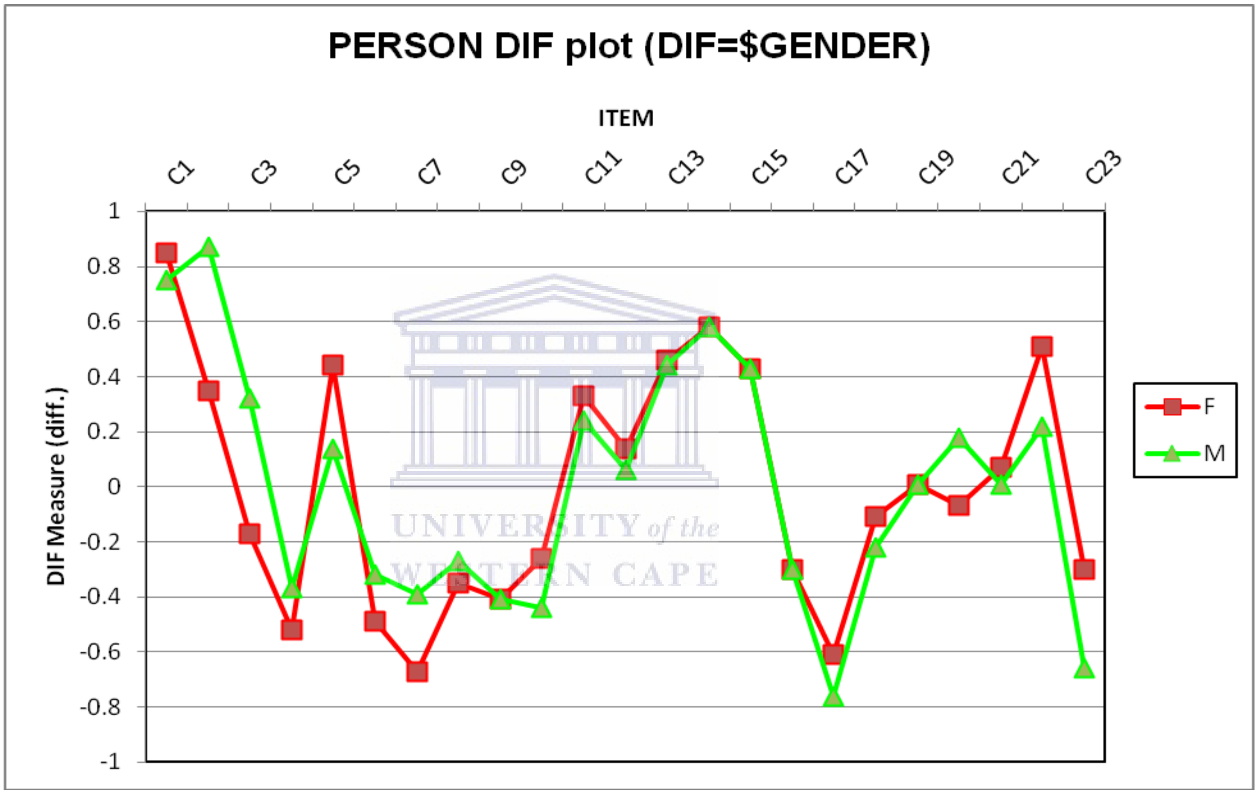

Table 9. *Gender Differential Item Functioning class specification*

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*

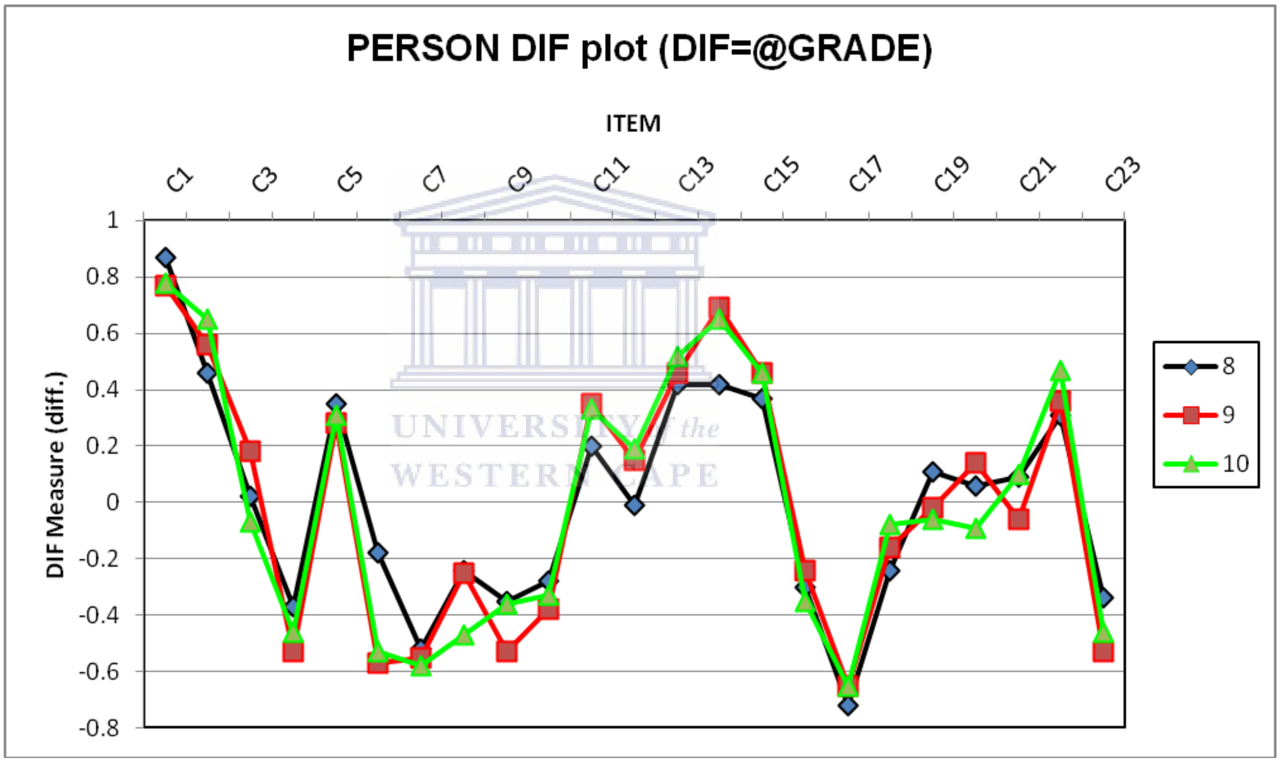

Table 10. *Grades Differential Item Functioning class specification* **(continue overleaf)**

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.

REFERENCES

Anderson, I. K., Sjøberg, S. & Ø. Mikalsen. (2008). What kinds of Science and Technology do pupils in Ghanaian Junior Secondary Schools want to learn about? In Holtman, L., Julie, C., Mikalsen, Ø., Mtetwa, D & M. Ogunnniyi (Eds.), *Some Development in Research in Science and Mathematics in Sub-Saharan Africa: Access, relevance, learning, curriculum, learning (pp. 335-356).* Somerset West: African minds.

Babbie, E. (1989). *The Practice of Social Research*. 5th edition. Belmont CA: Wadsworth.

Babbie, E. & J. Mouton. (2001). *The Practice of Social Research*. Oxford University Press, Cape Town.

Barnes, M.S. (2006). *A Comparison between the Contexts learners in Grades 8, 9 and 10 prefer for Mathematical Literacy* (Master's thesis). University of the Western Cape, Cape Town.

Biccard, P., & Wessels, D. (2011). Development of affective modelling competencies in primary school learners. *Pythagoras, 32*(1). Retrieved from http://dx.doi.org/10.4102/pythagoras.v32i1.20

Bishop, A. J., Hart, K., Lerman, S. & T. Nunes. (1993). *Significant influences on childrens' learning of mathematics.* Paris: UNESCO. Retrieved from http://www.unesco.org/education/pdf/323_47.pdf.

Blaauw, C. (2009). *A comparison of grade 8 to10 urban and peri-urban learners' context preferences for mathematical literacy* (Master's thesis). University of the Western Cape, Cape Town.

Bond, T.G. (2003). Validity and assessment: a Rasch measurement perspective. *Metodología de las Ciencias del Comportamiento 5(2)*, 179–194. Retrieved from http://eprints.jcu.edu.au/1799/1/bondValidity.pdf

Bond, T.G. and Fox, C.M. (2001). *Applying the Rasch model: Fundamental measurement in the human sciences.* Mahwah, N. J.: Lawrence Erlbaum Associates, Publishers.

Boone, W. & J. Rogan. (2005). Riguor in Quantitative analysis: The promise of rasch analysis techniques. *African Journal of Research in Science Mathematics and Technology Education*, *9*(1): 25-38.

Bradley, K., Sampson, S. & Royal, K. (2006). Applying the Rasch rating scale model to gain insights into students' conceptualisation of quality mathematics instruction. *Mathematics Education Research Journal, 18(2), 11-26.*

Brown, L. (2004). It's about Learning: From purpose to basic-level categories to meta-commenting. In Noyes, A. (Ed.) *Proceedings of the British Society for Research into Learning Mathematics.* Graduate School of Education, University of Bristol. *24(3).*

Burton, D. & S. Bartlett. (2009). *Key issues for education researchers*. London: sage.

Cavanagh, R.F. & Romanoski, J.T. (2006). Rating scale instruments and measurement. *Learning Environments Research*, *9*(3), 273-289.

Clarkson, P. C., Hannula, M. S., Brinkmann, A., Pálsdottir, G. & Rowland, T. (2004). Students' motivation and attitudes towards mathematics and its study. *ICME Topic Study Group*.

Cohen, D. K & D. L. Ball. (1990). Relation between policy and practice: An overview. *Educational Evaluation and Policy Analysis, 12*: 347-353.

Cornelissen, B. M. (2008). *A comparison between the contexts learners in Grades 8, 9 and 10 prefer for Mathematical Literacy and gender* (Master's thesis). University of the Western Cape, Cape Town.

Department of Education. (2006). National Curriculum Statement: Grade 11 – 12, Teacher's guide, Mathematical Literacy. Pretoria: DoE.

Donaldson, H. M. (2009). *Learning Together: Mathematics. Improving Scottish Education 2005-2008 - A report by HMIE on inspection and review 2005-2008*. Retrieved from http://www.hmie.gov.uk/documents/publication/ltm.pdf

Downe, K. (2008). Relevance of High School Mathematics to the Real World. Retrieved from http://www.edarticle.com/k-12-subject-areas/mathematics/relevance-of-high-school-mathematics-to-the-real-world.html

Foresman, S & A. Wesley. (2007). *The Importance of Mathematics: Elementary Schools Programs/Texts*. Retrieved from http://www.londonderry.org/assets/curriculum/importance_of_mathematics.pdf

Gall, M.D., Gall, J.P., & Borg, W.R. (2003). *Educational research: An introduction* (7th ed.). Boston, MA: Allyn & Bacon.

Glendis, M. A. & B. Strauss. (2004). *Emotions and Motivation: Changing Avoidance Goals into Achievement Goals by Giving Students Positive Emotional Experiences in the Mathematics Classroom.* New York. USA.

Goldin, G.A. (2007). Aspects of affect and mathematical modeling processes. In R.A. Lesh, E. Hamilton, & J.J. Kaput (Eds.), *Foundations for the future in mathematics education* (pp. 281−296). Mahwah: Lawrence Erlbaum Associates.

Goldin, G., Rösken, B. & Törner, G. (2009). Beliefs – No Longer a Hidden Variable in Mathematical Teaching and Learning Processes. In Maaß, J. & W. Schlöglmann (Eds.). *Beliefs and Attitudes in Mathematics Education: New research results*. Netherlands: Sense Publishers - Rotterdam.

Goulding, S. (1992). Analysis and presentation of information. In Bell, J. (Ed.). *Doing your research project (pp. 103-123).* Milton Keynes: Open University Press.

Gravemeijer, K. & Doorman, M. (1999). Context problems in realistic mathematics education: A calculus course as an example. *Educational Studies in mathematics*, *39*, 111-129.

Gunter, M. A., Estes, T. H. & Mintz, S. L. (2007). *Instruction: A models approach*. New York: Pearson Production, Inc.

Hannula, M. S. (2006). Affect in Mathematical Thinking and learning. In Maaß, J. & W. Schlöglmann (Eds.), *New mathematics education research and practice* (pp. 209-232). Rotterdam: Sense.

Holtman, L., Julie, C., Mbekwa, M., Mtetwa, D. & Ngcobo, M. (2011). A comparison of preferences for real-life situations that could be used in school mathematics in three SADC countries. *Southern African Review of Education*, 17: 120-137.

Julie, C., Holtman, L., & Mbekwa, M. (2011). Rasch modelling of Mathematics and Science teachers' preferences of real-life situations to be used in Mathematical Literacy. *Pythagoras*, *32*(1), 11-18. doi:10.4102/pythagoras. v32i1.13

Julie, C. & Holtman, L. (2008). The relevance of school mathematics education. In Holtman, *et al,*. (Eds.). *Science and Mathematics in Sub-Saharan Africa: Access relevance learning curriculum research* (pp. 379-405). Somerset west: African minds.

Julie, C. (2007). The contexts learners prefer for mathematical literacy and their link to present day South Africa. In Haines, C., Galbraith, P., Blum, W. & Khan, S. (Eds.). *Mathematical Modelling: Education, Engineering and Economics.* Chichester, England: Horwood Publishing Limited, 195 -202.

Julie, C. & Mbekwa, M. (2005). What would Grade 8 to 10 learners prefer as context for mathematical literacy? The case of Masilakele Secondary School. *Perspectives in Education, 23* (3), 31 – 43.

Kim, S. H. (2006). *Preferred Contexts for Mathematical Literacy of Korean grade 8 – 10 learners* (Master's thesis). University of the Western Cape, Cape Town.

Linacre, J. M. (2011). Glossary of Rasch Measurement Terminology. Based on: Wright, B.D. & Linacre J.M. (1985). *Microscale Manual. Westport, Conn.: Mediax Interactive Technologies, Inc.* Retrieved from www.rasch.org/rmt/glosario.htm

Linacre, J. M. (2011). Practical Rasch Measurement - Core Topics. Retrieved from www.statistics.com

Linacre, J. M. (2008). *Winsteps® Rasch measurement computer program user's guide*. Beaverton. Retrieved from http://www.winsteps.com/a/winsteps-manual.pdf

Linacre, J. M. & B. D. Wright. (2006). A User's Guide to Bigsteps: Rasch-Model Computer Program. Retrieved from http:// Winsteps.com

Londonderry School District Curriculum. (2007). Retrieved from

http://www.londonderry.org/documents/curriculum/importance_of_mathematics.pdf

Long, C. (2009). From Whole Number to Real Number: Applying Rasch Measurement to Investigate Threshold Concepts. *Pythagoras, 70,* 32-42.

Ma, X. & N. Kishor. (1997). Assessing the relationship between attitude toward mathematics and achievement in mathematics, a Meta-analysis. *Journal for Research in Mathematics Education 28(1), 26–47*.

Maaß, J. & W. Schlöglmann. (2009). *Beliefs and Attitudes in Mathematics Education: New Research Results.* Austria: Sense Publishers.

Mavhunga, F. Z., Sjøberg, S., Mikalsen, Ø & Julie C. 2008. What are the Interests of Zimbabwean Secondary School in School Science? In Holtman, L., Julie, C., Mikalsen, Ø., Mtetwa, D & Ogunnniyi, M. (Eds). *Some Development in Research in Science and Mathematics in Sub-Saharan Africa: Access, relevance, learning, curriculum, learning*. Somerset West. South Africa.

McLeod, D. (1992). Research on Affect in Mathematics Education: a reconceptualisation. In Grouws, D.A. (Ed.). *Handbook of Research in Mathematics Education Teaching and Learning* (pp.575-596), New York: Macmillan.

Messick, S. (1989). Validity. In R.L. Linn (Ed.), Educational measurement (3rd ed., pp. 13-103). New York: Macmillan.

Ministry of Education, National Institute for Educational Development (NIED), 2010. *Mathematics Syllabus Junior Secondary Phase Grades 8 – 10*, Okahandja, Namibia. Retrieved from http://www.nied.edu.na

Ministry of Higher Education Vocational Training Science and Technology (MHEVTST). (1999). *Reading and Math Achievement Levels: Education fact sheet.* Windhoek: Longman.

Mutodi, P. (2006). *Perceptions and interests of high-density secondary school students on applications of mathematics in work-related situations* (Master's mini thesis). University of Zimbabwe.

National Academy of Sciences (NAS). (1997). *Preparing for the 21st Century: The Education Imperative.* National Research Council (NRC). Retrieved from http://www.nap.edu/openbook.php?record_id=5777&page=2

Ndemo, Z. (2006). *Zimbabwean rural secondary school pupils' preferences of contexts for learning some mathematics topics* (Master's mini thesis). University of Zimbabwe.

Neuman, W. L. (2003). *Social research methods: Qualitative and quantitative approaches* (5th ed.) Boston: Allyn and Bacon.

Ngcobo, M. (2011). *Contexts preferred for use in mathematics by Swaziland high performing public schools' junior secondary learners* (Doctoral dessertation). University of the Western Cape, Cape Town.

Niss, M. (1996). Goals of Mathematics Teaching. In Bishop et al. (Eds.). *International Handbook of Mathematics Education, 1*(1), 11-47.

Niss, M. (1999). Aspects of the nature and state of research in mathematics education. *Educational Studies in Mathematics, 40(1): 1-24.* Netherlands: Kluwer Academic Publishers.

Niss, M. (2006). *The concept and role of theory in mathematics education*. Proceedings of NORMA05. Trondheim, Norway.

Niss, M. (2007). Reflections on the state of and trends in research on mathematics teaching and learning: From here to Utopia. In Lester, F. K. (Ed.). *Second Handbook of research on mathematics teaching and learning. 2*(31), 1293-1312.

Organisation for Economic Co-operation and Development (OECD) & PISA. (2006). *Assessment Framework: Mathematics, Reading, Science and Problem Solving Knowledge and Skills*. Retrieved from http://www.pisa.oecd.org/

Schoenfeld, A. (1985). *Mathematical problem solving*. Academic Press. Orlando (FL), USA.

Shmakov, P. & Hannula M. S. (2010). *Humour as means to make mathematics enjoyable: How can the teacher use humour to engage students' interest in math?*, pp. 144-153. Proceedings of CERME 6, Lyon: INRP. Retrieved from www.inrp.fr/editions/cerme6

Simon, J. L. (1969). *Basic research methods in social science*. 2nd Ed. New York: Random House.

The Ontario Mathematics Curriculum, Grades 1–8: Mathematics. (2004). Retrieved from http://www.edu.gov.on.ca

Verschaffel, L., Greer, B., & E. De Corte. (2000). Making sense of word problems. Retrieved from http://books.googlescholar.co.za/Making_sense_of_word_problems.html?id=y

Wright, B. D. (1977). Solving Measurement Problems with the Rasch Model. *Journal of Educational Measurement, Vol. 14*(2), 97-116. http://www.jstor.org/stable/1434010

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 **<u>you</u>** 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	