A comparison between the contexts learners in Grades 8, 9 and 10 prefer for Mathematical Literacy and gender

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Abstract

For many years, there have been calls for the mathematics curriculum in South African schools to be made more meaningful and relevant to young people's everyday lives. Despite efforts to address this issue, there is a widespread perception within the mathematics education community that much remains to be done.

Broadly, this study focuses on the contexts preferred by grade 8, 9 and 10 learners as a domain in which to embed mathematics. The particular focus is on whether gender plays a role in the preferences expressed by these learners for contexts.

The outstanding results emerging from the analysis clearly indicates a preference of both girls and boys to learn about mathematics that will allow them access to mathematics at tertiary institutions and mathematically related careers. The analysis also shows that the mathematics involved in financial planning for profit-making is favoured by both boys and girls.

The significance of this study is that it provides some insight into what learners prefer as contexts for learning mathematics. Hopefully, these insights can contribute to the improvement of mathematics teaching and learning.

DECLARATION

I declare that A comparison between the contexts learners in Grades 8, 9 and 10 prefer for Mathematical Literacy and gender is my own work, that it has not been submitted before for any degree or examination in any other university, and that all the sources I have used or quoted have been acknowledged by complete references.

B.M. Cornelissen March 2008

Signed: Belinda Cornelissen

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KEYWORDS

Mathematical Literacy

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Mathematical Modelling

Relevance of Mathematics

Learners' interest in Mathematics

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CHAPTER 1

INTRODUCTION

1.1 Background

For many years, there have been calls for the mathematics curriculum in South African schools to be made more meaningful and relevant to the general public's everyday lives. Despite efforts to address this issue, there is still a widespread perception within the mathematics education community that much remains to be done.

If a relevant curriculum is defined as a curriculum closely connected to the interests of learners then their preferences should also be taken into consideration as far as contextual situations are concerned. Contextual choices are not only based on the future needs of the individuals, but also on that of the society. However, the reality is that there is only a top down approach. In other words the adults (designers) make choices for the learners, which in terms of conventional wisdom makes sense, since they are the experts and the richness of their experience is of great value to the learners, as well as to society as such. Since research into what learners perceive as relevant and of interest, will give designers of learning resources for school mathematics a more comprehensive direction as to what contextual situations could be included in the mathematical curriculum. An awareness of the relevance of contexts with regard to interest, popularity and necessity is of utmost importance for the teaching of mathematics. A holistic approach in this regard is of importance.

Edwards and Ruthven (2003: 249-260) found that young people are capable of identifying at least some mathematics embedded within a wider range of everyday activities than previously thought, and that the factors influencing their mathematical representations are very complex. Previous research suggested that pupils' representations of the mathematical dimensions of a particular activity may be influenced by stereotyped ideas about the people associated with that activity. However the study conducted by Edwards and Ruthven (2003) found no evidence to support this suggestion.

The use of contexts in school mathematics is accorded much currency nationally and internationally. It has resulted in the advent and incorporation of mathematical literacy into the Further Education and Training [FET] (Grade 10-12) curriculum and competence therein is generally viewed as:

> …the capacity to identify, understand and engage in mathematics, and to make well-founded judgments about the role that mathematics plays in an individual's current and future private life, occupational life, social life with peers and relatives, and life as a constructive, concerned and reflective citizen (OECD, 2001:22).

1.2 Research Question

This study is concerned with contexts learners in grades 8 to 10 prefer to deal with in mathematical literacy.

The particular focus is to ascertain whether there are gender differences in preferences for contexts for learners in grades 8 to 10 from low socio-economic status households in urban and peri-urban environments.

1.3 Motivation

It is widely accepted that schools should graduate learners who are mathematically literate. This study was inspired by the introduction of the National Curriculum Statement for South Africa in the FET Phase to be implemented from 1 January 2006. As from this date mathematical literacy has become an alternative to mathematics as a subject. This will make it compulsory for all South African school-going children to either do mathematics or mathematical literacy in the last three grades of secondary school. In the past, high-school learners had the option to not select mathematics as a subject as part of their curriculum. It will now be interesting to establish which contexts learners from low socio-economic status urban and peri-urban schools would prefer in the learning of mathematics.

Julie and Mbekwa (2005: 34) state that this study, essentially deals with the issues and situations that learners would prefer to deal with in mathematics. This appears to be a topic that is relatively under-researched.

In this regard my study supervisor advised that we conduct web searches using key phrases like “learners and contexts in mathematics”, “students and context in mathematics”, pupils and contexts in mathematics”, “issues learners are interested about in mathematics”, etc. to study and view literature related to this topic. These keywords rendered no hits. When the database MathDi was searched using general phrases like “mathematics and contexts” it rendered almost 700 hits. However, those articles do not deal specifically with the learners’ preferred contexts in mathematics. The study by De Bock, Verschaffel, Janssens, Van Dooren and Claus (2003) refers to the effect of contexts on learners’ achievements in mathematics whilst the study of Edwards and Ruthven (2003) focuses on learners’ identification of mathematics in everyday activities.

1.4 Conclusion

This chapter dealt with the introduction and background to the study.

Chapter two focuses on literature related to the use of contexts in mathematics and mathematical literacy, mathematical modelling and how it relates to contexts and mathematical literacy as well as issues related to gender and school mathematics, including the use of contexts in mathematics and gender.

Chapter three discusses the methodology used in this study. The particular research approach used is motivated and the instrumentation, data collection and data analysis procedures are discussed.

Chapter four deals with the presentation and analysis of the collected data against the research question.

Chapter five highlights the conclusions and offers recommendations for design and further research.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The previous chapter gave an overview of the context of the research project and research questions arising from it. It further dealt with the motivation for the research project. This chapter focuses on the use of contexts in mathematics and mathematical literacy, on mathematical modelling and how it relates to contexts and mathematical literacy and on issues related to gender and school mathematics.

2.2 Definitions

In this section various constructs of importance are reviewed and particularized for this study.

2.2.1. Mathematical Literacy

The definition of mathematical literacy has been debated internationally for decades. Although various definitions exist world-wide, this researcher feels confident with the definition originating from the Organisation for Economic Co-operation and Development's (OECD) Programme for International Student Assessment (PISA).

PISA defines mathematical literacy as “an individual’s capacity to identify and understand the role that mathematics plays in the world, to make well-founded mathematical judgments and to engage in mathematics, in ways that meet the needs of that individual’s current and future life as a constructive, concerned and reflective citizen” (OECD,2001: 22). Romberg (2001:5) paraphrases it as follows:

“an individual’s capacity”—individual differences

“to engage in mathematics”—mathematics as a discipline

“constructive, concerned and reflective citizen”—accountable citizenship

“make well-founded mathematical judgments”—critical citizenship

More broadly the term “literacy” refers to the use- or non-use of language by human beings.

Romberg (2001) develops the definition of mathematical literacy by viewing it as part of literacy generally. In this regard he states that “the term ‘literacy’ refers to the human use of language.” (p5). This implies the ability to read, write, listen and generally also use a language in a variety of situations at hand. According to Romberg (2001: 5):“For a person to be literate in a language implies that he or she knows many of the design resources of the language and is able to use those resources for several different social functions.”

Furthermore, mathematics according to Romberg should be analogously viewed as a language where concepts and procedures of mathematics are used to solve non-routine problems.

The current Revised National Curriculum Statement (RNCS) as implemented by the Department of Education in 2000 promotes mathematical literacy amongst all learners in South Africa.

The National Department of Education define mathematical literacy as "Being literate in mathematics" as a requirement for the development of the responsible citizen, the contributing worker and the self-managing person. To be mathematically literate implies an awareness of the manner in which mathematics is used to format society and empower the ordinary citizen to better understand the products of mathematics such as hire purchase agreements. Therefore the inclusion of mathematical literacy is a fundamental requirement in the National Department of Education of South Africa (RNCS, 2002:48).

In the South African curriculum documents, a difference is made between mathematical literacy and mathematics. In grades R to 9 pupils are expected to master a mixture of numeracy and mathematics whilst, in the FET (grades 10 to 12), there is a clear distinction between mathematical literacy and mathematics. Table 1 illustrates the differences between mathematics and mathematical literacy.

Table 1: Learning Outcomes of Mathematical Literacy and Mathematics (DoE, 2003)

MATHEMATICAL LITERACY	MATHEMATICS
LEARNING OUTCOME 1 **Numbers and Operations in Context:** The learner is able to **use** knowledge of numbers and their relationships to **investigate a range of different contexts** which include financial aspects of personal, business and national issues.	**LEARNING OUTCOME 1** **Numbers and Number Relationships:** When solving problems, the learner is able to **recognise, describe, represent** and work confidently with numbers and their relationships to **estimate, calculate and check solutions**.
LEARNING OUTCOME 2 **Functional Relationships:** The learner is able to recognise, interpret, describe and represent various functional relationships to solve problems in real and simulated contexts.	**LEARNING OUTCOME 2** **Functions and Algebra:** The learner is able to investigate, analyse, describe and represent a wide range of functions and solve related problems.

LEARNING OUTCOME 3 **Space, Shape and Measurement:** The learner is able to measure using appropriate instruments, to estimate and calculate physical quantities, and to interpret, describe and represent properties of and relationships between 2-dimensional shapes and 3-dimensional objects in a variety of orientations and positions.	**LEARNING OUTCOME 3** **Space, Shape and Measurement:** The learner is able to describe, represent, analyse and explain properties of shapes in 2-dimensional and 3-dimensional space with justification.
LEARNING OUTCOME 4 **Data Handling:** The learner is able to collect, summarise, display and analyse data and to apply knowledge of statistics and probability to communicate, justify, predict and critically interrogate findings and draw conclusions.	**LEARNING OUTCOME 4** **Data Handling and Probability:** The learner is able to collect, organise, analyse and interpret data to establish statistical and probability models to solve related problems.

The emphasis in mathematical literacy is to use or apply the mathematical knowledge and skills in contexts of real life situations.

2.2.2 Context

The Concise Oxford Dictionary (1998) defines context as ambient conditions or surrounding conditions (ambi = both sides; ire = go). Context therefore, refers to the settings and situations in which mathematical literacy is applied.

Baker (1996) is of the opinion that contexts depend on how the individual perceives them. An appropriate context for one person may thus not be so for another. In this study context is viewed as a concept of a non-mathematical nature which can be interrogated by mathematical means.

2.2.3 Gender differences

Fennema (2000) uses the word 'gender' to imply the social or environmental causation of differences that are observed between sexes. When referring to the word 'sex' she is actually referring to biologically determined behaviours. It is not always possible to separate social and biological influences and perhaps it is not always necessary to do so. In this study the position of non-separation between the social and biological is adopted.

2.2.4 Relevance of Mathematics

The South African concise Oxford Dictionary (2002) states that relevance means: "Closely connected or appropriate to the matter in hand". Alternatively, relevance could also embrace the whole idea of interest.

When we say something is relevant we mean of interest to the role-players, stakeholders or participants. In this study relevance is seen as having reference to contexts which learners are interested in. It is my contention that mathematics is relevant to most spheres of activity in society in which human beings are involved. Quantitative, numerical or mathematical interpretations are sometimes part of those real life situations. People must make sense of these mathematical interpretations or mathematically-based arguments.

The debate about research for the relevance of mathematics is prominent in many countries and has been pursued over a long period of time. Ernest (1996) argues that mathematics fulfils social needs, provides the skills relevant to everyday life and work in industrial and developing societies and forms the basis for further study in mathematics, science and technology. The selection of content and the mode of teaching in mathematics often is claimed to be driven by relevance to these needs.

Ernest (1996) further states that what is often overlooked, perhaps less so today, is that 'relevance' and 'need' are not neutral nor objective judgments, but are based on the perspective of the judge, and the aims at which the judgments are directed. It must be mentioned that if a judgment is based on the perspective of the judge it is no longer objective. At this stage there is already an indication that 'relevance' and 'need' will mean different things to different people.

2.3 Mathematical Modelling

Mathematical literacy is about using mathematics to deal with extra-mathematical situations. In a broad sense mathematical modelling is embedded in Applied Mathematics which is the mathematically-based discipline dealing primarily with contexts. Julie and Mbekwa (2005: 32) argue that for mathematical literacy to be a distinct school subject, the use of contexts should be given priority in it. Mathematical literacy falls within the realm of "applications" and "modelling of mathematics" viewed in a comprehensive sense as both "modelling" which focuses on the direction reality to mathematics and "application" which focuses on the opposite direction of mathematics to reality. Thus mathematical literacy cannot be viewed outside of mathematical modelling which is discussed below.

Mathematical modelling is a process which is aimed at developing mathematical representations for situations from outside of mathematics. Frequently, in a mathematical modelling situation, a phenomenon that is seemingly non-mathematical (in context) must be modelled by mathematical means. This may be an event in the realm of politics, such as predicting election results; of economics, such as finding the long-term behaviour of oil prices; or even of ecology, such as predicting the future growth patterns of a forest. There is thus an inter-relationship between reality and mathematics because of the existence of mathematical devices to control, organize, predict and manipulate nature and social life. These situations can be regarded as quantitative situations.

In mathematical modelling important factors must be discerned, relationships must be determined, and these relationships must be mathematically interpreted. The mathematical representation of phenomena allows for an analysis of the phenomenon so that conclusions can be generated.

According to Julie (2004) there are three domains involved in mathematical model-making, namely: the extra- mathematical reality domain, consensus- generated reality domain and the intra- mathematical domain. The figure 1 below shows the characteristics of these domains as outlined by Julie (2004:35). It is clear from the figure that the three domains of mathematical modelling complement each other and build up a more comprehensive description of a complex process for mathematical treatment. Julie (2004) further points out that the reality situation is transformed through consensus where interests and purposes are settled and the resulting mathematisation relates to this consensus-generated reality. The characteristics of these domains are reflected in figure 1 as outlined by Julie (2004:35).

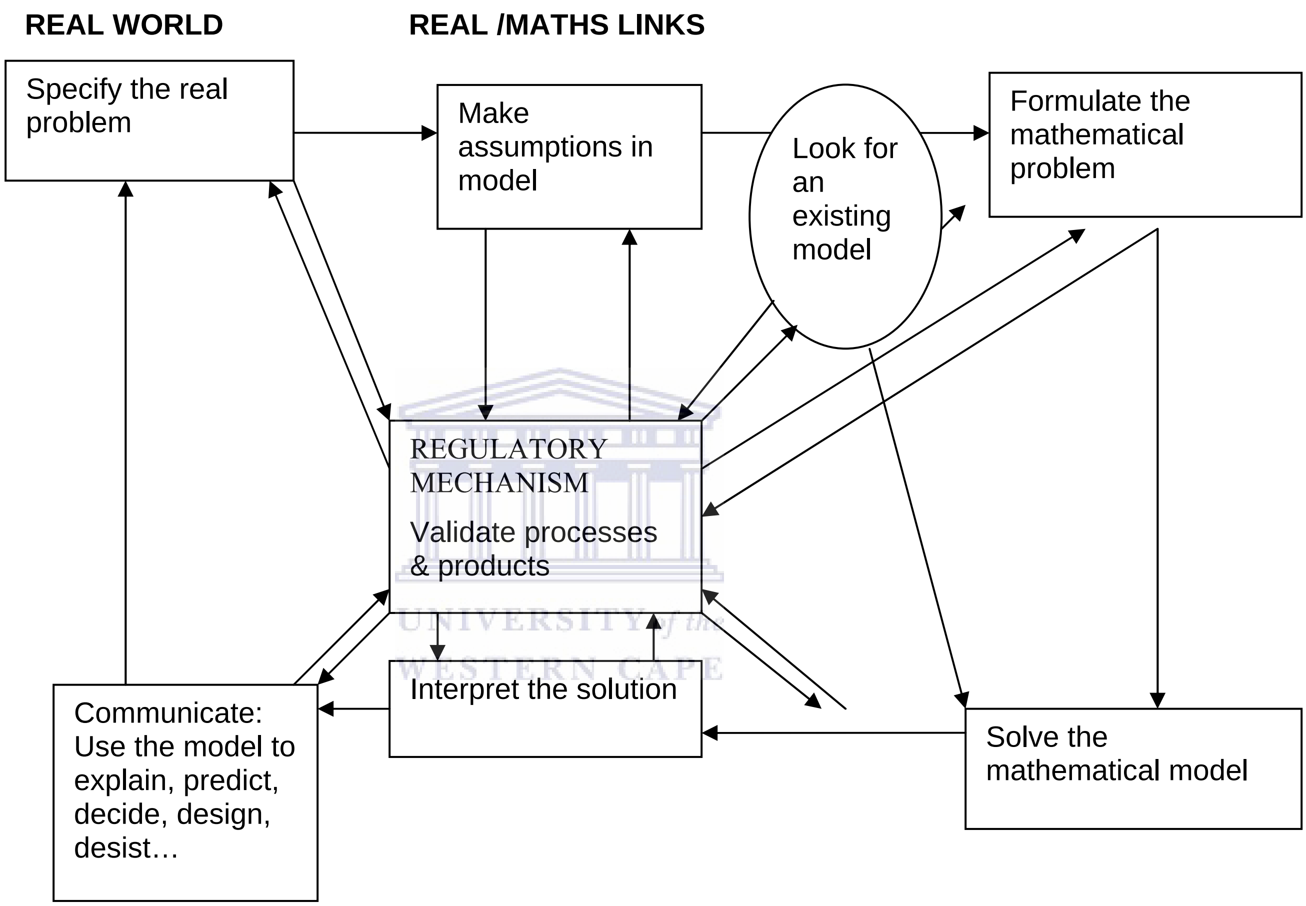
Figure 1: Domains of mathematical modelling

EXTRA-MATHEMATICAL REALITY DOMAIN	CONSENSUS – GENERATED REALITY DOMAIN	INTRA-MATHEMATICAL DOMAIN
Issues of a technical, physical, financial, social, political, environmental nature are at stake. Issues are complex and under a variety of influencing factors.	Issues are stripped of some influencing factors. Consensus is reached based on purposes and interests.	Mathematical procedures and ideas are developed and used. Mathematical conclusions are reached.

Source: Julie 2004

Many representations exist that illustrate the processes involved in mathematical modelling. One of the models that is more enlightening is that of Stillman (1998:245) given in Figure 2 below. Observable from the Stillman model is the attention given to the "regulatory mechanisms" involved in the processes of mathematical modelling.

Figure 2: Processes involved in mathematical modelling



Source: Stillman's (1998) Mathematical Modelling Presentation

According to the Mathematics Learning Programmes Guidelines (Department of Education, 2004)

Mathematical Models are subdivided into three types. These are:

a. **Direct models**. These are models that can be directly generated from verbal representations. The model is an exact representation of the situation rather than an attempt to bring mathematics to bear on an imprecise real world problem. For example, functions created in linear programming problems are direct models.

b. **Physical models**. Using objects or diagrams to physically model a situation produces these models. At times this may require building objects to act as models thereby enabling us to produce a mathematical analysis of the situation.

c. **Data models.** These models are generated as a line of best fit for a set of data. The model may not fit the data perfectly but is the best fit for the data. Data sets may be obtained from experiments conducted by the learners or they may be obtained from other sources e.g. NGOs; Statistics South Africa; Government departments (Department of Education, 2004: 84 – 85).

This presentation of the Department of Education deals more with examples of types of situations from which mathematical models can be developed.

2.4 Gender and Mathematics

The topic of gender and mathematics has been studied for some time. According to Leder (1996) there were probably more research studies published on gender and mathematics than on any other topic during the years 1970 and 1990.

Fennema (1974) asserts that there is evidence to support the idea that there were differences between girls and boys' learning of mathematics, particularly in activities that required complex reasoning.

The major findings deriving from research related to gender and mathematics are:

- Gender differences in mathematics may be decreasing;
- Gender differences in mathematics still exist in:
  - learning of complex mathematics;
  - personal beliefs in mathematics; and
  - career choices that involves mathematics
- Gender differences in mathematics vary according to:
  - socio-economic status and ethnicity;
  - school and
  - teacher
- Teachers tend to structure their classrooms to favour males and

- Interventions can move towards achieving equity in mathematics. (See, for example, Leedy, Lalonde & Runk (2003) and Gallagher (2005))

Recent research also addresses the issue of gender structuring in learning resources for mathematics. A study by Davis (1997:1) investigated whether textbook publishers were successful in solving the "problem of achieving politically correct gender and racial representations in the textbooks." An in-depth analysis of one textbook was done and gender representation was focused on. His analysis rendered that

> Despite [the fact that]…on the first reading an apparent gender neutrality [is exhibited]…it became clear that various textual strategies are employed to distribute mathematical ability differentially to male and female readers. The dominant textual learner which emerges from this reading of the text is a male autodidact. Where the feminine does appear it is almost always subordinated to the masculine and is used as a resource to facilitate male mathematising of the social: the dominant voice of school mathematics is masculine and its subordinate voice is female (pp 14-15)

This study deals with gender and the contexts learners would prefer to apply school mathematics to. The next section thus discusses gender and the use of contexts in mathematics.

2.5 Gender and the use of contexts in mathematics

Gender and the use of contexts in school mathematics is, generally an under-researched area. Searches of research databases and web-trawling using the key phrases given in Table 1 rendered very few hits. This implies that this topic is not currently widely researched.

Table 2: Sentences and phrases used in web-trawl search

Gender and the use of contexts in school mathematics
Gender and contexts in school mathematics after 2000
Contexts and mathematics in school mathematics
The use of contexts and gender in school mathematics
Use of contexts in mathematics by girls
Use of contexts in mathematics by boys

Research by the Assessment of Performance Unit (APU) has shown that the context of an assessment task may disadvantage girls, as girls often value the circumstances that a task is presented in (Murphy, 1990). Murphy (1990) suggested that boys are less likely to be affected by context and that boys are able to distance themselves from contexts to a greater extent.

Boaler (1994:551-564) conducted a small scale study which aimed to contrast the effectiveness of a process-based learning environment with a content-based learning environment.

The research was concerned with the extent to which students could transfer their mathematical knowledge and understanding across different task contexts. The assumption behind this investigation was that if a student could transfer knowledge across different task contexts they would be more likely to transfer this knowledge from the classroom to the real world.

The research findings by Boaler (1994) and Burton (1986) suggest that a more open and less threatening environment which values communication and negotiation encourages girls' interests and combats under-achievement. The research further suggests that when students learn mathematics in a process-based environment, girls and boys will attempt to integrate real world variables with the mathematics of a task, an approach which must provide a good basis for tackling real world problems.

It has been mentioned above that the use of contexts occurs in mathematical modelling and the applications of mathematics. In order to further search for more studies related to the use of contexts and mathematics, which are relevant for this study, the last three conference publications of the International Conference on the Teaching of Mathematical Modelling and Applications (Ye, Blum, Houston and Jiang (2003); Lamon, Parker and Houston (2003) and Haines, Galbraith, Blum and Khan (2007)) were examined for occurrences of studies dealing with the issue of importance in this mini-thesis. No such studies on gender and contexts in mathematics were found.

Also the recent International Commission on Mathematical Instruction's comprehensive study on modelling and applications (Blum, Galbraith, Henn and Niss, (2007)) had no reports on gender and contexts learners would prefer to deal with in mathematics. This again points to the paucity of research on this topic.

2.6 Conclusion

From the literature review it is clear that context-preferences and gender in school mathematics is not a well-researched issue. This researcher however, attempted to give a literature overview of the key aspects related to the preferred context in school mathematics and gender. The relevance of mathematics, definitions of mathematical literacy, issues related to the use of contextual situations in school mathematics, mathematical modelling as well as the use of contexts in mathematics and gender were discussed. The next chapter focuses on the research methodology.

CHAPTER 3:

RESEARCH METHODOLOGY

3.1 Introduction

This chapter deals with the methodology used in this study. The particular research approach used is motivated and the instrumentation, data collection and data analysis procedures are discussed.

3.2 Survey Research

The research approach used in this study falls under survey research. Survey research is normally used when the research interest is in gaining information about people's perceptions of preferences with regard to interests in, attitudes toward, etc. issues of importance to the researchers. Silverman (2000: 53) classifies surveys as one of the approaches of quantitative research which mainly uses fixed–choice response formats to questions of importance to the issue being investigated. Survey research uses questionnaires as data-gathering technique.

As is the case with all research methods there are advantages and disadvantages in using survey research. The following, amongst others, can be seen as the main advantages:

- In general it is a quick process to obtain a lot of information covering a large area within a short period of time.
- The questionnaires can be administered, analyzed and reported on within a short time.

The major disadvantages of surveys are:

- There is always the risk that a certain percentage of the questionnaires will never be returned if the questionnaires are sent to respondents to complete on their own.
- When respondents experience problems with certain items on the questionnaire, it cannot be addressed due the fact that there is a lack of face to face contact. (Silverman, 2000: 53- 57)

The study reported here is concerned with the preference learners have for contexts to be used in school mathematics. The preferences of learners from a particular socio-economic background and in particular grades were of importance. For these reasons survey research was deemed appropriate for this study.

3.3 Instrumentation

The research instrument was developed from 2003 to 2005 by a number of mathematics educators from Zimbabwe, Uganda, South Africa, Eritrea, Norway and a group of mathematics teachers from South Africa. (Julie and Mbekwa, 2005:33). The researcher was part of the South African teacher cohort involved in this collective.

Julie and Mbekwa (2005) give a comprehensive description of the process of development of the instrument. Basically various contextual issues of interest for learners were first identified and debated by the South African participants. Through competitive argumentation an initial set of contexts was decided upon. The South African participants tested some of the items in their classrooms in order to check whether learners understood the task and whether they had any difficulties with the language. After this the questionnaire was pilot-implemented in one school. The results were analysed (Julie and Mbekwa, 2005). The questionnaire and the findings were deliberated upon by the entire cohort. Some items were deleted and new ones added. A feature of the contexts selected was that they should be amenable to mathematical treatment. To ensure this the units and modules on the application of mathematics developed by the Consortium for Mathematics and its Applications (Garfunkel, 2004) were studied to ascertain the mathematical amenability of the identified contexts. The final questionnaire, the Relevance of School Mathematics Education (ROSME) (Appendix A), was completed in January 2005.

The questionnaire contained sixty one fixed response items. For these items learners had to indicate their preference on a four-point Likert–type scale with response categories “not at all interested”, “a bit interested”, “quite interested” and “very interested”. The last four items required open responses and are not of relevance to this mini-thesis.

The questionnaire consists of 13 clusters of different contexts with each cluster consisting of a certain number of items. There are two intra–mathematical clusters—mathematics and mathematicians' practices—and eleven extra–mathematical clusters. The clusters, number of items in a cluster and an exemplar item are indicated in Table 3.1 below.

Table 3.1: Clusters

Cluster	**Number of items**	**Exemplar Indicator Item**
Mathematics	6	Mathematics that will help me to do mathematics at universities and technikons
Mathematicians' Practices	5	The kind of work mathematicians do
Health	5	Mathematics involved in determining the state of health of a person
Physical Sciences	2	Mathematics about renewable energy sources such as wind and solar power
Technology	4	Mathematics involved in sending of messages by sms, cellphones and e-mail
Sport	3	Mathematics involved in my favourite sport
Agriculture	4	Mathematics involved for deciding the number of cattle to graze in a field of a certain size
Finance	5	Mathematics involved in working out financial plans for profit- making
Politics	4	Mathematics used to calculate the number of seats for parliament given to political parties after elections
Youth Culture	5	Mathematics linked to rave and disco dance patterns
Life Science	5	How to predict the sex of a baby
Transport and Delivery	4	Mathematics involved in designing delivery routes of goods such as delivering bread from a bakery to the shops
General	9	Mathematics involved in military matters

3.4 Sampling

The sample use in the study was an opportunistic and convenient one. Data were collected from schools in urban and peri-urban areas. Teachers attending courses at the University of the Western Cape (UWC) were requested to administer the questionnaire (Appendix A) at their own and surrounding schools. In a particular school one Grade 8, one Grade 9 and one Grade 10 class were targeted to complete the questionnaire. The distribution in terms of urban and peri-urban regions of the Western Cape Province is indicated in Table 3.2 below:

Table 3.2: Regions of schools

Region Type	Urban	Peri – urban
District	Cape Peninsula	Klein Karoo, Southern Cape, West Coast and Boland

The age distribution of the sample is given in Table 3.3, the gender distribution in Table 3.4, regional distribution in Table 3.5 and grade distribution in Table 3.6.

Table 3.3: Age

	Age	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	**12**	2	0.2	0.2	0.2
	13	129	10.9	10.9	11.1

	14	274	23.3	23.3	34.4
	15	351	29.8	29.8	64.2
	16	246	20.9	20.9	85.1
	17	113	9.6	9.6	94.7
	18	50	4.2	4.2	98.9
	19	7	0.6	0.6	99.5
	20	3	0.3	0.3	99.8
	21	1	0.08	0.08	99.9
	23	1	0.08	0.08	100.0
	Total	**1177**	**100**	**100**	

Table 3.4: Gender

	Gender	**Frequency**	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	**Girl**	627	53.3	53.3	53.3
	Boy	550	46.7	46.7	100.0
	Total	**1177**	**100.0**	**100.0**	

Table 3.5: Region

	Region	**Frequency**	**Percent**	**Valid Percent**	**Cumulative Percent**

Valid	**Peri-Urban**	702	59.6	59.6	59.6
	Urban	475	40.4	40.4	100.0
	Total	**1177**	**100**	**100**	

Table 3.6: Grade Distribution

Valid	Grade	Frequency	Percent	Valid Percent	Cumulative Percent
	8	391	33.2	33.2	33.2
	9	260	22.1	22.1	55.3
	10	526	44.7	44.7	100
	Total	1177	100	100	

Given that the data collectors taught in schools and environments situated in low socio-economic areas it can be reasonably assumed that the sample was fairly representative of learners in grades 8, 9 and 10 from LSES-areas in the Western Cape Province.

3.5 Data Collection Processes

Principals of the sample schools were approached by representatives of the Relevance of School Mathematics Education (ROSME) research group with regard to the project. Permission was obtained from the school principals to collect data after explaining to them what the purpose was and what would be done with the data. Data for the study was collected in the different school districts or regions of the Western Cape Education Department between March and June 2005.

The ROSME research group went out to the different schools and in some cases steered this process in the class. Learners were asked to participate voluntarily and could withdraw any time during the process.

The student researcher went through each question with the participating learners in order to make sure that the learners understood the nature of each question. This was a lengthy process and due to logistics, student researchers in some instances could not finish the data collection process. It took more than an hour to complete the questionnaire whilst the length of a school period was on average fifty minutes. In such cases the mathematics teachers at the participating schools were asked to complete the process. Teachers thus only did the outstanding cases that the student researchers could not complete.

3.6 Data Analysis

Before discussing the data analysis procedures used in this study, a brief description of the nature of the data is provided. Data are categorized as nominal, ordinal, interval and ratio data. Nominal data are the lowest level of data and this type of data can be categorized and frequencies calculated in each category. Examples of nominal data are gender, marital status and age. Ordinal data are generated when observations are placed into order categories.

This type of data is derived from the assessment of subjective responses, data that cannot be measured, for example degree of satisfaction or interest. The distance between each scale step is not important-the only requirement being that there is an order between them such as very bad, bad, good and very good. Interval and ratio data are numerical data with consistent spacing. An example of interval data is a set of test results and an example of a ratio scale is age. It should be noticed that interval and ratio data are numeric if they had numeric values originally. Hence, re-coded nominal and ordinal data are not numeric and should not strictly be analyzed as numeric values.

Descriptive statistical presentation of continuous data, such as mean and standard deviation as well as parametric tests were not used for the analysis of the data because these methods make several underlying assumptions such as consistent spacing and normal distribution of the data. For the analysis of ordinal data medians, quartiles (or range) and non-parametric tests are preferable. The data in this survey are ordinal and hence non-parametric procedures were used.

A common procedure to analyse ordinal data is to determine the mean rankings of the items under consideration. A procedure used to calculate mean rankings is the Kendall

W- test which was chosen for this study. The Kendall W (coefficient of concordance)-test is used for expressing inter-rater agreement among independent judges who are rating (ranking) the same stimuli. In this study the learners were the raters and the items the stimuli.

The Mann-Whitney test was chosen to test whether there were significant differences between the rankings provided by boys and girls. In essence the Mann-Whitney test uses medians to test for significant differences. All tests were performed using SPSS version 13. Inevitably there are advantages and disadvantages to non-parametric methods.

Major advantages of non-parametric methods are:

- Non-parametric methods require no or very few assumptions to be made about the format of data, and they therefore are preferable when the assumptions required for parametric methods are not relevant. This was the case in this study.
- Non-parametric methods can be useful for dealing with unexpected observations that might be problematic.

On the other hand, non-parametric methods have the following disadvantages:

- Non-parametric methods may lack power as compared with more traditional approaches, particularly if the sample size is small;

- Non-parametric methods are geared toward hypothesis testing rather than estimation;

- Tied values can be problematic when these are common; and
- Appropriate computer software for non-parametric methods is limited, although improving. In addition, how a software package deals with tied values or how it obtains P values may not always be obvious. (Whitley and Ball, 2002:18).

3.7 Issues on Reliability and Validity

The research instrument, namely the learners' questionnaire, was a product of regular changes and improvement by the Relevance of School Mathematics Education (ROSME) group over a period of three years. The large number of mathematics educators and researchers from a number of countries made it possible to construct a well thought through learners' questionnaire and items dealing with a large variety of contextual situations and issues which could be dealt with in mathematical literacy and mathematics.

Personal involvement of the student and principal researchers pertaining to data collection from the learners was the order of the day. The researchers were at the schools to give guidance and to clarify each item, making sure that uncertainty and the lack of understanding were to a large extent eliminated.

3.8 Conclusion

This chapter dealt with survey research as an appropriate methodological approach for this study. The data collection instrument, data collection procedures and the analysis procedures used were discussed. Furthermore the sampling procedure and the nature of the sample were provided. The next chapter focuses on the main research findings and a detailed discussion of these findings.

CHAPTER 4

FINDINGS AND INTERPRETATION OF RESULTS

4.1 Introduction

The previous chapter discussed the research design methodology and suitable means of measuring the relevant variables. Appropriate statistical procedures were selected to analyse the data that were obtained. This chapter focuses on the findings of the contexts grade 8, 9 and 10 learners prefer to deal with in mathematics. The most- and the least-preferred items the cohort of learners like to deal with along gender lines are presented and discussed. This is followed by the findings for the different grades.

4.2. Most-preferred items overall

Table 4.1 presents the 15 highest ranked items selected by the girls and boys.

Table 4.1: Fifteen items highest ranked by girls and boys

Item Code	Girls	Mean Rank	Boys	Mean Rank	Item Code
C23	Mathematics that will help me to do mathematics at universities and technikons	47.46	Mathematics that will help me to do mathematics at universities and technikons	46.72	C23
C11	Mathematics that is relevant to professionals such as engineers, lawyers and accountants	42.11	Mathematics that is relevant to professionals such as engineers, lawyers and accountants	42.43	C11
C15	Mathematics involved in secret codes such as pin numbers used for withdrawing money from an ATM	41.48	Numbers	40.44	C45

C45	Numbers	41.40	Mathematics involved in secret codes such as pin numbers used for withdrawing money from an ATM	40.21	C15
C46	Mathematics involved in the sending of messages by sms, cellphones and e-mails	38.97	Mathematics involved in making computer games such as play stations and TV games	39.05	C3
C47	Mathematics involved in working out financial plans for profit- making	38.74	The kind of work mathematicians do	38.35	C26
C26	The kind of work mathematicians do	38.01	Mathematics involved in sending of messages by sms, cellphones and e-mails	37.96	C46
C22	Mathematics to prescribe the amount of medicine a sick person must take	37.93	Mathematics involved in working out financial plans for profit- making	37.40	C47
C21	Mathematics to assist in the determination of the level of development regarding employment, education and poverty of my community	37.27	Geometry	36.82	C27
C27	Geometry	37.11	Mathematics of the storage of music on CD's	36.11	C42
C16	Mathematics used to calculate the taxes people and companies must pay to government	37.10	Algebra	35.81	C34
C20	Mathematics involved in determining the state of health of a person	36.43	Mathematics used in making aeroplanes and rockets	35.26	C7
C51	How to predict the sex of a baby	36.16	How mathematicians make their discoveries	35.21	C29
C5	Mathematics used to predict the growth and decline of epidemics such as AIDS; tuberculosis and cholera	36.16	Mathematics involved in the placement of emergency services such as police stations, fire brigades and ambulance stations so that they can reach emergency spots in the shortest possible time	35.18	C24
C54	Mathematics to monitor the growth of a baby during the first stage of its life	35.18	Mathematics to prescribe the amount of medicine a sick person must take	34.46	C22

Of the 15 highest ranked items, 9 were selected by both the boys and the girls. These are presented in Table 4.2.

Table 4.2: Common most-preferred items by girls and boys

Item Code	Item	Girls Mean Rank	Boys Mean Rank
c23	Mathematics that will help me to do mathematics at universities and technikons	47.46	46.72
c11	Mathematics that is relevant to professionals such as engineers, lawyers and accountants	42.11	42.43
c15	Mathematics involved in secret codes such as pin numbers used for withdrawing money from an ATM	41.48	40.21
c45	Numbers	41.40	40.44
c46	Mathematics involved in sending of messages by SMS, cell phones and e-mails	38.97	37.96
c47	Mathematics involved in working out financial plans for profit-making	38.74	37.40
c26	The kind of work mathematicians do	38.01	38.35
c22	Mathematics to prescribe the amount of medicine a sick person must take	37.93	34.46
c27	Geometry	37.11	36.82

Of the nine, five (c23, c11, c45, c26 and c27) can be deemed as directly linked to mathematics as it is currently practised in schools.

These are the intra-mathematical items and although there are differences in the mean rankings, girls and boys do not generally differ in terms of their preference of mathematics as a discipline. It is interesting to note that both the girls and the boys ranked the item (c23) dealing with access to tertiary institutions as their highest preferred. This points in the direction of learners at this stage of their schooling careers displaying a desire to complete school and pursue further studies. However, it is well known that very few of the learners reach the final year of schooling, grade 12. This finding is also contrary to TIMSS 2003 result where only 34% of grade 8 students reported the aspiration to undertake university studies (Mullis, Martin, Gonzalez and Chrostowski, 2004).

Two of the items (c15 and c46) in the highest ranked 15 items deal with modern day technologies. This is indicative of the pervasiveness and high visibility of these issues in South African society. Girls and boys do not markedly differ in their high preference for dealing with modern technological issues in mathematics. Dealing with the mathematics involved in financial planning for profit-making is also accorded high preference by both the boys and the girls. Given the high bureaucratic and political visibility of entrepreneurship and self-employment and the concomitant media popularization of the success stories around these issues, it is conjectured that this inspires learners to want to learn more about profit-making.

The last item of high preference agreement between boys and girls is related to health. The item, c22, is more on the curative side.

A variety of explanations can be provided for this high preference for both girls and boys. It, however, seems plausible that young people in this age cohort have a curiosity about how medicine dosages are determined as a consequence of their own experiences of taking and/or administering dosages of medicine.

The six most-preferred items that only the girls ranked amongst the 15 highest ranked items can be collapsed into three categories. These are: health (c20 and c5), community matters (c21 and c16) and sexuality matters (c51 and c54). Girls selected 3 items (c22, c20 and c5) related to health relative to the one item (c22) selected by boys in the 15 highest preferred items. Girls thus have a stronger preference for issues pertaining to health. This concurs with a generally held belief that girls have a stronger inclination towards the well-being of others than boys.

Linked to the health issue is the girls' high preference for community affairs relative to boys. This appears to bolster the perception of a more caring and altruistic inclination amongst girls relative to boys. Lastly, the girls selected items dealing with sexuality matters within their 15 highly-preferred set of items. It is especially the item dealing with the growth, and thus the health of a baby, which again points to the selection of items relating to the instincts of caring, well-being and altruism which seems to characterise girls more than boys.

Of the six items selected by boys and not by girls, one can be categorized as a technological cluster. The items belonging to this cluster are: Mathematics involved in making computer games such as play stations and TV games (c3) and the mathematics of the storage of music on CD's (c42). The general perception that boys are more interested in technological gadgets than girls seems to be supported by this finding. In addition, the boys, by selecting items c7 and c24 related to “high speed travel”, reinforce the common perception that society is patterned into ‘male’ and ‘female’ things.

Lastly, boys relative to girls bolstered their high preference for disciplinary study of mathematics by selecting a further item (c29) from this cluster.

4.3 Least-preferred items overall

The 15 items least preferred by the girls and boys are shown in Table 4.3.

Table 4.3: The 15 least-preferred items by boys and girls

Item code	Girls	Mean Rank	Boys	Mean Rank	Item Code
C7	Mathematics used in making aeroplanes and rockets.	26.54	Mathematics to determine the number of fish in a lake, river or a certain section of the sea	26.93	C37
C59	Mathematics to describe movement of big groups of people in situations such as emigration and refugees fleeing from their countries	26.25	Mathematics to describe movement of big groups of people in situations such as emigration and refugees fleeing from their countries	26.82	C59
C10	Mathematics political parties use for election purposes	25.78	Strange results and paradoxes in Mathematics	26.70	C53
C8	How to estimate and project crop production	25.36	Mathematics involved in determining levels of pollution	25.91	C60
C43	Mathematics linked to decorations such as the house decorations made by Ndebele women	25.15	How to estimate and project crop production	24.93	C8
C37	Mathematics to determine the number of fish in a lake, river or a certain section of the sea	25.15	Mathematics political parties use for election purposes	24.50	C10
C31	Mathematics used to calculate the number of seats for parliament given to political parties after elections	25.05	Mathematics involved in packing goods to use space efficiently	23.80	C28
C25	Mathematics involved in making complex structures such as bridges	23.85	Mathematics used to calculate the number of seats for parliament given to political parties after elections	23.48	C31
C56	Mathematics to describe facts about diminishing rain forest and growing deserts	23.70	Mathematics involved in working out the best arrangement for planting seeds	23.16	C36

C28	Mathematics involved in packing goods to use space efficiently	22.46	Mathematics involved in designing delivery routes of goods such as delivering bread from a bakery to the shops	23.11	C13
C13	Mathematics involved in designing delivery routes of goods such as delivering bread from a bakery to the shops	22.28	Mathematics involved for deciding the number of cattle, sheep or reindeer to graze in a field of a certain size	22.35	C17
C36	Mathematics involved in working out the best arrangement for planting seeds	21.68	Mathematics needed to work out the amount of fertilizer needed to grow a certain crop	21.80	C14
C14	Mathematics needed to work out the amount of fertilizer needed to grow a certain crop	21.62	Mathematics linked to designer clothes and shoes	21.58	C1
C17	Mathematics involved for deciding the number of cattle, sheep or reindeer to graze in a field of a certain size	19.69	Mathematics of a lottery and gambling	19.45	C2
C2	Mathematics of a lottery and gambling	19.14	Mathematics linked to decorations such as the house decorations made by Ndebele women	18.02	C43

Of the fifteen lowest ranked items, twelve items are common to the boys and the girls. These are indicated in Table 4.4 below.

Table 4.4: Common least- preferred items by girls and boys

Item Code	Item	Boys Mean Rank	Girls Mean Rank
C43	Mathematics linked to decorations such as the house decorations made by Ndebele women	18.02	25.15
C2	Mathematics of a lottery and gambling	19.45	19.14
C14	Mathematics needed to work out the amount of fertilizer needed to grow a certain crop	21.80	21.62
C17	Mathematics involved for deciding the number of cattle, sheep or reindeer to graze in a field of a certain size	22.35	19.69

C13	Mathematics involved in designing delivery routes of goods such as delivering bread from a bakery to the shops	23.11	22.28
C59	Mathematics to describe movement of big groups of people in situations such as emigration and refugees fleeing from their countries	26.82	26.25
C8	How to estimate and project crop production	24.93	25.36
C10	Mathematics political parties use for election purposes	24.50	25.78
C28	Mathematics involved in packing goods to use space efficiently	23.80	22.46
C31	Mathematics used to calculate the number of seats for parliament given to political parties after elections	23.48	25.05
C36	Mathematics involved in working out the best arrangement for planting seeds	23.16	21.68
C37	Mathematics to determine the number of fish in a lake, river or a certain section of the sea	26.93	25.15

Of the twelve, four can be deemed as directly linked to agriculture. It is interesting to note that both the boys and girls ranked the items (c8, c14, c17 and c36) as the least preferred. Crop estimation, projection and efficient use of grazing fields are very low on the agenda of these learners. A lack of interest in agriculture as a setting in which to study mathematics or mathematical literacy is evident from learners' choices.

Boys ranked the item c43 as the least preferred. Mathematics linked to decorations such as the house decorations made by Ndebele women deals with the mathematical analysis of cultural art which links to indigenous knowledge. Most of these learners come from urban and peri-urban areas and therefore it could be one of the reasons that Ndebele paintings is at the bottom of the boys list. This kind of work relates to geometry and it appears in the curriculum for mathematics in both the GET and FET phases.

Another rather interesting result is the low position of c2. This response is contradictory due to the fact that the lottery is the government's initiative to generate funds for non-governmental organizations. Learners show very low interest in the national lottery and gambling despite saturation advertising, live drawings on television and the fact that participants can be instant millionaires.

Politics is the third least preferred cluster. The interest in politics is driven by the issue of apportionment after elections (c10, c31 and c59). These learners are coming from communities that were previously excluded from the political processes in South Africa. People from previously disadvantaged communities have a long history of fighting for political freedom and the fact that learners show low interest in this cluster to study mathematics or mathematical literacy is a contradiction.

The item related to designer clothes and shoes (c1) indicated as one of their lowest preferred issues by boys suggests that boys have a low interest in fashion. This corresponds with a generally held belief that girls have a stronger preference for issues pertaining to fashion. Girls selected 2 items (c7 and c25) related to engineering whereas none were selected by boys. The general view that boys are more interested in engineering than girls seems to be supported by this finding.

The last item of low preference agreement between boys and girls is related to sustainability of natural resources. This item (c37) is related to environmental issues which are encouraged as a context for mathematics in the GET and FET phases.

The Mann-Whitney test was used to evaluate the differences between the rankings of the boys and girls. The null hypothesis is that the populations from which the two samples have been drawn are identical. The Mann-Whitney test rendered the results as given in Table 5 in which the mean rankings of the contexts preferred by girls and boys emerged.

Table 5: Results from the Mann-Whitney test

(* - in list of least-preferred items by boys; ** - in list of most-preferred items by boys; *** - in list most-preferred by girls; **** - in list of least-preferred by boys and girls but ranked lower by girls; ***** - in list most-preferred by boys and girls but ranked higher by girls)

Item	**Mann-Whitney U**	**Z**	**Asymp. Sig. (2-tailed)**
Mathematics linked to designer clothes and shoes	140788.5	-4.469629306	7.8355E-06*
Mathematics involved in making computer games such as play stations and TV games	144136	-3.71710783	0.000201516**
Mathematics used in making aeroplanes and rockets.	122557	-7.845747384	4.30383E-15**
Mathematics involved for deciding the number of cattle, sheep or reindeer to graze in a field of a certain size	148716	-3.292925774	0.000991506****
Mathematics involved in determining the state of health of a person	143737	-4.003197401	6.2492E-05***
Mathematics to assist in the determination of the level of development regarding employment, education and poverty of my community	145522	-3.942824189	8.0527E-05***
Mathematics to prescribe the amount of	141972	-4.219238417	2.4512E-05*****

medicine a sick person must take			
Mathematics involved in making complex structures such as bridges	130506	-6.784049805	1.1685E-11*****
Mathematics to monitor the growth of a baby the first period of life	140734	-4.134186512	3.5621E-05***

As mentioned above the item related to designer clothes and shoes (c1) was in the list of the 15 least preferred items of boys and not in that of the girls. The Mann-Whitney result indicates that the different ranking positions obtained between the boys and girls are significant.

The items “mathematics involved in making computer games such as play stations and TV games” and “mathematics used in making aero planes and rockets” appear in the list of 15 highest preferred items of boys and also indicate that the different ranking positions of these items are significant. It lends further support to the notion of boys’ higher preference for contexts of a technological nature. This conclusion is further supported by the item “mathematics involved in making complex structures such as bridges” appearing in the list of the 15 least-preferred items by girls and the difference in ranking positions being significant.

Girls have ranked the items “mathematics involved in determining the state of health of a person”; “mathematics to assist in the determination of the level of development regarding employment, education and poverty of my community” and “mathematics to monitor the growth of a baby the first period of life” significantly higher than boys.

These items are representative of a maternal, nurturing inclination and lend further support to girls' preference for issues related to care. Further support regarding this issue is the boys' ranking of the item “mathematics involved in deciding the number of cattle, sheep or reindeer to graze in a field of a certain size” in their least-preferred list and significantly lower than girls. Still further support for this assertion is that although the item “mathematics to prescribe the amount of medicine a sick person must take” appears amongst the 15 highest-ranked items of the boys and girls, the higher ranking position by girls is significant.

4.4 The most preferred items in grades 8 to 10

Table 6: Most preferred items in the different grades

Grade 8				Grade 9				Grade 10			
Girls	**Mean Rank**	**Boys**	**Mean Rank**	**Girls**	**Mean Rank**	**Boys**	**Mean Rank**	**Girls**	**Mean Rank**	**Boys**	**Mean Rank**
C23	44.29	C23	43.02	C23	47.20	C23	46.03	C23	49.78	C23	49.42
C15	43.11	C45	40.74	C15	40.50	C11	41.77	C11	46.95	C11	44.20
C46	42.48	C3	40.68	C45	40.23	C15	40.63	C47	43.62	C45	42.92
C45	42.33	C11	40.53	C11	40.01	C46	38.96	C45	42.65	C26	41.70
C11	39.40	C26	39.70	C27	37.88	C3	38.88	C15	42.00	C15	40.65
C5	38.08	C47	38.27	C46	37.82	C45	38.36	C26	41.22	C34	40.00
C20	37.57	C15	38.23	C22	37.38	C42	37.61	C22	40.82	C29	38.69
C26	36.54	C27	38.21	C51	37.21	C58	37.20	C16	40.70	C3	38.47
C27	36.28	C46	37.68	C47	36.98	C24	36.64	C21	40.58	C47	38.39
C16	36.08	C42	36.83	C21	36.75	C47	36.29	C34	39.86	C7	38.15
C3	35.90	C58	36.44	C26	36.49	C27	35.49	C46	38.63	C12	38.02
C42	35.55	C52	35.02	C54	36.12	C48	35.49	C29	37.73	C27	37.82
C47	35.12	C6	34.89	C20	35.58	C26	35.19	C20	37.04	C46	36.83
C55	34.59	C22	34.50	C5	35.28	C49	35.17	C27	36.42	C55	36.71
C12	34.57	C29	34.41	C24	35.20	C22	34.54	C5	36.35	C4	36.24

The items, c11, c15, c23, c26, c27, c45, c46 and c47 for the different genders in the different grades do not differ from the 15 highest-ranked overall items.

However, the items c21, c22, c51 and c54 appear in the list of the 15 highest-ranked overall items and not in the lists for the different genders in the different grades.

4.5 The least preferred items in grades 8 to 10

Table 7: Least preferred items in the different grades

Grade 8				**Grade 9**				**Grade 10**			
Girls	**Mean Rank**	**Boys**	**Mean Rank**	**Girls**	**Mean Rank**	**Boys**	**Mean Rank**	**Girls**	**Mean Rank**	**Boys**	**Mean Rank**
C8	26.67	C8	27.08	C7	26.87	c18	26.55	C37	25.59	C38	25.75
C14	25.17	C9	26.20	C31	26.20	C10	26.13	C7	25.27	C32	25.53
C41	25.07	C10	26.11	C59	26.04	C59	26.10	C59	25.01	C37	24.71
C9	25.01	C53	25.84	C10	25.94	C53	26.02	C57	24.45	C30	24.44
C37	25.01	C33	25.54	C43	25.13	C13	25.24	C31	24.37	C40	24.35
C28	24.88	C56	24.82	C37	24.91	C31	25.23	C10	24.31	C8	24.30
C56	24.74	C28	24.81	C56	24.49	C60	25.07	C25	23.72	C28	22.38
C53	24.63	C17	24.55	C8	24.42	C8	24.60	C1	23.35	C36	22.33
C36	24.59	C18	24.43	C25	24.18	C28	24.54	C56	21.88	C10	21.64
C18	23.63	C60	24.10	C28	22.62	C36	23.70	C43	21.69	C31	21.08
C33	23.35	C31	23.83	C13	22.61	C17	23.17	C36	20.89	C17	20.24
C17	23.34	C1	23.71	C14	21.38	C1	22.47	C28	20.75	C14	19.82
C31	23.26	C36	23.44	C36	21.06	C14	21.27	C14	19.85	C1	19.42
C25	23.25	C43	21.72	C2	19.72	C2	20.75	C17	19.52	C13	18.41
C2	20.26	C2	19.79	C17	18.37	c43	18.64	c13	19.00	c2	17.64

Items c17, c28, c31 and c36 for the different genders in the different grades do not differ from the 15 least-preferred overall items even though the items c10, c13, c43 and c59 appear in the list of the 15 least-preferred overall items and not in the different genders in the lists for the different grades.

4.6 Conclusions

Overall, judging from the rankings of the different grades in respect of the different items, there seem to be no significant differences in the contexts preferred by the grades 8 to 10. However, the categories caring, engineering and technology showed there are differences. It appears as if all three grades accord almost similar rankings to items.

A discussion of the key findings, conclusions and recommendations are presented in the next chapter.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The issue pursued in this study was to determine whether gender differences exist for the contexts learners prefer to deal with in school mathematics. Survey research was used to ascertain learners' preferences for contexts. In this final chapter the findings are discussed in relation to the primary research question and recommendations are offered.

5.1 Key findings

5.1.1 Contexts selected by both girls and boys

The outstanding result emerging from the analysis is the clear preference of both boys and girls to learn about mathematics that will allow them to do tertiary studies and give them access to careers that were previously dominated by the white minority in South Africa. Learners are aware that mathematics is one of the gateway subjects. Learners from low socio-economic environments are also aware of financial support available to them if their results in mathematics are satisfactory and that they are given the opportunity to gain access to the large variety of career prospects which are open to learners where mathematics is a prerequisite.

The mathematics involved in financial planning for profit-making is favoured by both boys and girls. It is not surprising that these learners from previously disadvantaged communities living in a capitalist society favour financial planning for profit-making. It seems that these learners perceive profit-making as a means to escape their circumstances and the topic of a global economy and financial matters interests them. These learners also see the opportunity to be self-employed and to become entrepreneurs.

The most important findings of this study are that learners from grades 8, 9 and 10 from low-socio- economic environments find mathematics as the key to tertiary-level success and mathematicians' practices as the most preferred items. Text book writers, mathematics and mathematical literacy teachers who seek to take cognisance of the interest of learners coming from low socio-economic environments could use this data and findings to influence their choices of context.

5.1.2 Contexts highly favoured by girls and not by boys

Girls are generally interested in learning about how mathematics is applied to issues related to health. It seems that girls value people's health as very important.

Given the extensive coverage in terms of educating people about HIV/AIDS and of ways to prevent people from contracting it, these learners prefer to learn about the mathematics required for the prescription of the amount of medicine a sick person must take. Regardless of the fact that the department urges teachers to integrate HIV/AIDS into their learning areas, learners prefer to learn more about health contexts that are not just limited to the HIV/AIDS context.

Looking at the two items which deal with community matters, namely "mathematics to assist in the determination of the level of development regarding employment, education and poverty of my community" and "mathematics used to calculate the taxes people and companies must pay to government" one senses a trend of social consciousness amongst the girls. These items point to a large extent towards social welfare and social responsibility. The last item of high preference for girls is related to matters of sexuality. This again illustrates that girls are more conscious of issues of sexuality than boys.

5.1.3 Contexts highly favoured by boys and not by girls

"Mathematics involved in sending of messages by sms, cellphones and e-mails", "mathematics of the storage of music on CD's" and "mathematics used in making aeroplanes and rockets" were contexts ranked very high by the boys.

Boys are generally interested in learning about how mathematics is applied to issues related to technology. It appears as if technology is one of the factors driving the interest levels of the boys. The mathematicians' practices cluster which includes items such as "how mathematicians make their discoveries" points towards a trend of social consciousness amongst the boys.

5.1.4 Contexts accorded a low preference by boys and not by girls

This study also focused on the least preferred items of grades 8, 9 and 10 learners. Despite extensive coverage in terms of marketing, advertisements and live drawings on television, the item, lottery and gambling elicited the lowest interest of all the items amongst the grade 8 and grade 9 boys. Perhaps it is due to the fact that an age restriction prevents them from participating.

Agriculture is at the bottom of the list for the grade 10 boys. The majority of these learners come from urban and peri-urban areas which could contribute to the fact that agriculture is at the bottom of the list. Planting seeds and harvesting crops reminds them of the way that their parents grew up during the apartheid years and can be associated with impoverish circumstances.

With regard to this Julie and Mbekwa (2005:40) assert:

> The policy for land reform and redistribution in South Africa is also aimed at providing the opportunity for agricultural production to be more equitably distributed across the country's population. If the low interest is indicative of a trend of young people's interest in agricultural matters then much motivational work at school level will have to be done to ensure a flow of new entrants into the agricultural sector to allow the South African government's policy to have the desired effects.

5.1.5 Contexts accorded a low preference by girls and not by boys

The political cluster, which includes items such as "mathematics political parties use for election purposes' and "mathematics used to calculate the number of seats for parliament given to political parties after elections" - appears to have little appeal to the girls across the grades. Agriculture is also one of the least preferred clusters. Agriculture is related to poverty alleviation and one would expect that learners, coming from a low socio-economic environment would want to learn about mathematics linked to these matters.

A surprising result is the low interest girls have in items such as 'mathematics used in making aeroplanes and rockets" and "mathematics involved in making complex structures such as bridges". Perhaps it can be ascribed to past discriminatory practices whereby women were excluded from being employed as engineers, technicians, etc. "Mathematics of a lottery and gambling" received the lowest ranking by girls across the grades as a preferred context in which to embed mathematics. This low ranking seems to be in line with the results of a study conducted by Wits University on youth gambling which was commissioned by the South African National Gambling Board (2005).

5.2 Recommendations

I recommend that various textual strategies are employed in textbooks to cater for the different contexts preferred by both girls and boys. A caveat, however, is that preferences for contexts cannot be assumed to be permanently fixed. They change as circumstances and conditions change thus necessitating a constant assessment to be made by curriculum developers, learning resource designers and teachers of the contexts that learners prefer. Given the potential of the use of contexts to foster 'connected' ways of thinking and particularly girls' preference for this kind of thinking, contexts that they favour might contribute towards alleviating girls' underachievement in school mathematics.

5.3 Conclusions

The major conclusion that can be drawn from the key findings above is that the contexts preferred by learners in grades 8, 9 and 10 are not directly gender neutral.

As indicated the preferences differ and still follow patterns of a male-dominated worldview. For example, as stated before, engineering and technology are viewed as male-dominated domains and this view also comes through in this study. Similarly, an inclination towards caring and well-being is normally associated with females and the learners' choices of preferences seem to support this view.

Given the challenges faced by learners the focus should be on what interests learners, how learners learn and understand mathematics and how to base instructional decisions on this knowledge. It further requires change in all aspects and levels of the educational system, which extends far beyond the mathematics classroom, into the community and global society.

This study proved to be significant in that it provided some insights into what learners prefer as contexts for learning mathematics enabling us as teachers to be creative in our teaching.

Julie (2006:56) proposes a mathematics for action in which the "Teachers' interests in contexts related to issues of social import from the background of students provides a base for action orientation in mathematical literacy". He mentions examples like including letter writing to the press and staging demonstrations aimed at, for example, poverty alleviation.

Motivations provided by learners for their mathematical preferences have the potential to make a major difference to the teaching of mathematical literacy in South Africa. Thus the motivations of learners' preferences have to be taken in consideration and implemented in classroom practice.

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APPENDIX

CODE:…………………

RELEVANCE OF SCHOOL MATHEMATICS EDUCATION (ROSME)

January 2005

Things I'd like to learn about in Mathematics

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

I am in Grade …………….

What would you like to learn about in mathematics? Some possible things are in the list below. Beside each item in the list, circle only one of the numbers in the boxes to say how much you are interested. Please respond to all the items.

1 = Not at all interested
2 = A bit interested
3 = Quite interested
4 = Very interested

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

For office use	Things I'd like to learn about in Mathematics	**Not at all interested**	**A bit interes ted**	***Quite interested***	**Very interested**
C1	**Mathematics linked to designer clothes and shoes**	1	2	3	4
C2	Mathematics of a lottery and gambling	1	2	3	4
C3	Mathematics involved in making computer games such as play stations and TV games	1	2	3	4
C4	Why mathematicians sometimes disagree	1	2	3	4
C5	**Mathematics used to predict the growth and decline of epidemics such as AIDS; tuberculosis and cholera**	1	2	3	4
C6	The personal life stories of famous mathematicians	1	2	3	4
C7	Mathematics used in making aeroplanes and rockets.	1	2	3	4
C8	How to estimate and project crop production	1	2	3	4
C9	Mathematics to predict whether certain species of animals are on the brink of extinction	1	2	3	4
C10	Mathematics political parties use for election purposes	1	2	3	4
C11	Mathematics that is relevant to professionals such as engineers, lawyers	1	2	3	4

	and accountants				
C12	**How mathematics is used to predict the spread of diseases caused by weapons of mass destruction such as chemical, biological and nuclear weapons**	1	2	3	4
C13	Mathematics involved in designing delivery routes of goods such as delivering bread from a bakery to the shops.	1	2	3	4
C14	Mathematics needed to work out the amount of fertilizer needed to grow a certain crop	1	2	3	4
C15	Mathematics involved in secret codes such as pin numbers used for withdrawing money from an ATM	1	2	3	4
C16	Mathematics used to calculate the taxes people and companies must pay to the government	1	2	3	4
C17	Mathematics involved for deciding the number of cattle, sheep or reindeer to graze in a field of a certain size	1	2	3	4
C18	Mathematics of inflation	1	2	3	4
C19	Mathematics about renewable energy sources such as wind and solar power	1	2	3	4
C20	Mathematics involved in determining the state of health of a person	1	2	3	4
C21	Mathematics to assist in the determination of the level of development regarding employment, education and poverty of my community	1	2	3	4

C22	Mathematics to prescribe the amount of medicine a sick person must take	1	2	3	4
C23	Mathematics that will help me to do mathematics at universities and technikons	1	2	3	4
C24	Mathematics involved in the placement of emergency services such as police stations, fire brigades and ambulance stations so that they can reach emergency spots in the shortest possible time	1	2	3	4
C25	Mathematics involved in making complex structures such as bridges	1	2	3	4
C26	The kind of work mathematicians do	1	2	3	4
C27	Geometry	1	2	3	4
C28	Mathematics involved in packing goods to use space efficiently	1	2	3	4
C29	How mathematicians make their discoveries	1	2	3	4
C30	Mathematics linked to South African pop music	1	2	3	4
C31	Mathematics used to calculate the number of seats for parliament given to political parties after elections	1	2	3	4
C32	Mathematics involved in assigning people to tasks when a set of different tasks must be completed	1	2	3	4
C33	Blunders and mistakes some mathematicians have made	1	2	3	4

C34	Algebra	1	2	3	4
C35	Mathematics about the age of the universe	1	2	3	4
C36	Mathematics involved in working out the best arrangement for planting seeds	1	2	3	4
C37	Mathematics to determine the number of fish in a lake, river or a certain section of the sea	1	2	3	4
C38	Mathematics linked to music from the United States, Britain and other such countries	1	2	3	4
C39	Mathematics that air traffic controllers use for sending off and landing planes	1	2	3	4
C40	Mathematics linked to rave and disco dance patterns	1	2	3	4
C41	Mathematics involved in making pension and retirement schemes	1	2	3	4
C42	Mathematics of the storage of music on CD's	1	2	3	4
C43	Mathematics linked to decorations such as the house decorations made by Ndebele women	1	2	3	4
C44	Mathematical ideas that have had a major influence in world affairs	1	2	3	4
C45	Numbers	1	2	3	4
C46	Mathematics involved in sending of messages by SMS, cellphones and e-mails	1	2	3	4
C47	Mathematics involved in working out financial plans for profit-making	1	2	3	4
C48	Mathematics involved in my favourite sport	1	2	3	4

C49	Mathematics involved in dispatching a helicopter for rescuing people	1	2	3	4
C50	Mathematics used to work out the repayments (instalment) for things bought on credit are worked out	1	2	3	4
C51	How to predict the sex of a baby	1	2	3	4
C52	How mathematics can be used by setting up a physical training program, and measure fitness.	1	2	3	4
C53	Strange results and paradoxes in Mathematics	1	2	3	4
C54	Mathematics to monitor the growth of a baby the first period of life	1	2	3	4
C55	Mathematics that entertain and surprise us.	1	2	3	4
C56	Mathematics to describe facts about diminishing rain forest and growing deserts.	1	2	3	4
C57	How mathematics can be used in planning a journey	1	2	3	4
C58	How mathematics can be used in sport competitions like ski jumping, athletics, aerobic, swimming, gymnastics and soccer.	1	2	3	4
C59	Mathematics to describe movement of big groups of people in situations such as emigration and refugees fleeing from their countries.	1	2	3	4
C60	Mathematics involved in determining levels of pollution.	1	2	3	4
C61	Mathematics involved in military matters.	1	2	3	4

C62 Please down 3 issues that you are very interested in learning about the use of mathematics in these issues.

(a)
…………………………………………………………………………………………

(b)
…………………………………………………………………………………………

(c)
…………………………………………………………………………………………
.
Why are you interested in these issues?
…………………………………………………………………………………………

…………………………………………………………………………………………

…………………………………………………………………………………………

C63 Are you interested in learning something on mathematics that arises while you are learning other school subjects?

YES أ NO أ

Why? ……………………………… Why not? ……………………………………

……………………………… ……………………………………

……………………………… ……………………………………

……………………………… ……………………………………

C64 Are you interested in learning something on mathematics related to issues that have been in the newspapers or radio or TV recently?

YES أ NO أ

Why? ……………………………… Why not? ……………………………………………

……………………………… ……………………………………………

……………………………   ……………………………………………

…………………………….   …………………………………………….

C65 Make a sketch or drawing of a mathematician working.