CONTEXT PREFERENCES OF TEACHERS IN SOUTH AFRICA AND SOUTH KOREA FOR MATHEMATICS IN SCHOOLS

G. P. VAN SCHALKWYK

NOVEMBER 2007

Context Preferences of Teachers in South Africa and South Korea for Mathematics in schools

A mini thesis submitted in partial fulfillment of the requirements for the degree Magister Educationis in the Faculty of Education University of the Western Cape

Gregory Peter van Schalkwyk
M.Ed Student 7500573

Supervisor: Professor C. Julie

NOVEMBER 2007

DECLARATION

I declare that:

Context Preferences of Teachers in South Africa and South Korea for Mathematics in schools is my own work and that it has not been submitted before for any degree or examination at any university.

All the sources I have used or quoted in this mini thesis have been indicated and acknowledged as complete references.

Gregory Peter van Schalkwyk 13 December 2007

……………………………………
Signed

ABSTRACT

The study is located within the project: *Relevance of School Mathematics Education* (ROSME) of the Department of Didactics at the University of the Western Cape. The research is undertaken in the belief that Mathematics enables creative and logical reasoning about contextualised problems in the realm of the physical and social world as well as in the discipline mathematics itself. Relevance of school Mathematics has the implied notion of contextual issues. This research attempts to investigate the contextual issues that teachers have to deal with in Mathematics education. Given the results of the TIMMS report, this research aims to investigate, through comparison, the context preferences between a selected group of practicing teachers in South Africa and those of their counterparts in South Korea.

The contexts most preferred by the South African teachers were the Mathematics that will help learners at Universities and technikons, the Mathematics involved in health matters such as the amount of medicine to be taken and the spread of HIV/AIDS and the mathematics involved in making bridges and airplanes and rockets. The South Korean teachers preferred the Mathematics involved in the making of bridges, airplanes and rockets, the Mathematics involved in sustainability issues as well the mathematics involved in the construction of bridges, airplanes and rockets.

The contexts least preferred by both cohorts are the Mathematics involved in gambling, military matters and disco and rave dancing.

This study provides insight into the contexts preferred by teachers to be included in a Mathematics learning programme that might enhance Mathematics teaching and learning.

ACKNOWLEDGEMENTS

With the fast changing school curriculum post 1994 in South Africa, I became aware of the need of research to be done about education to enable the planners of the curriculum to make educationally sound decisions. Having been a mathematics educator for the past twenty six years and having been involved with the construction of a framework for the development of mathematics education in South Africa, I became inspired to undertake this study in an attempt to contribute to the intellectual wisdom that forms the basis for further debate, study and development in mathematics education.

I would like to express my appreciation and gratitude to the following persons and institutions without whose support and guidance, the production of this thesis would not have been possible:

The competent and efficient staff of the Library at The University of the Western Cape as well as Edulis Library in Bellville who assisted me in gathering information.

My parents, for the unqualified support and encouragement through the years.

My wife Veronica and daughters Alexis and Nicole for having sacrificed quality family time to enable me to complete this study.

My supervisor, Professor Cyril Julie, for his thoroughness, patience and endurance to ensure that I complete this task successfully. The National and international stature of Prof. Julie served as an inspiration to me during the time of my engagement with the research for this thesis.

Finally I thank my Creator for giving me the perseverance to complete this task.

Soli Deo Gloria

TABLE OF CONTENT

LIST OF TABLES AND FIGURES

KEYWORDS

Mathematics

Mathematical Literacy

Modelling

Applications

Context

Content

CHAPTER 1

FROM CONTENT DRIVEN TO CONTEXT-BASED MATHEMATICS TEACHING

1.1 Introduction

In 1995, the South African Government began the process of developing new curricula for the school system. According to the Department of Education (2005), the existing school curricula no longer meet the demands of the 21st century in terms of the higher level of skills and values required. Secondly, the socio-political environment in South Africa has changed after the first democratic elections of 1994. South Africa has adopted a new Constitution and the need arose for school curricula to reflect new values and principles as imbedded in the Constitution of the country.

The first version of the new curriculum for the General Education and Training (GET) band was known as Curriculum 2005 (C2005).This curriculum was introduced in the Foundation Phase in 1997. The plan was that it should have been phased into the system so that the first learners who passed through the school system in this curriculum, would have done so in 2005, hence the name Curriculum 2005.

Because of widespread public pressure and concerns of teachers, the Government of South Africa in 1999 called for a review of C2005. The general objection to C2005 was that it was vague and was written in a language style that was not easily understood by teachers. The review of C2005 led to the development of the Revised National Curriculum Statement (RNCS) for General Education and Training (GET) and the National Curriculum Statement (NCS) for Further Education and Training (FET).

Whereas Mathematics was a subject of choice in the Senior Secondary phase of the old curriculum in South Africa, Mathematics and Mathematical Literacy have become fundamental subjects in the FET phase of the new curriculum. This means that all learners will have to offer either Mathematical Literacy or Mathematics as part of their subject portfolios as a prerequisite for the awarding of a school leaver's certificate, the National Senior Certificate.

In South Africa, the Mathematical Literacy and Mathematics Committee of the Department of Education (DoE) defined Mathematics as "The construction of knowledge that deals with qualitative and quantitative relationships of space and time. It is a human activity that deals with patterns, problem solving, logical thinking etc., in an attempt to understand the world and make use of that understanding. This understanding is expressed, developed and contested through language, symbols and social interaction." (DoE, 1996: 6). The Task Team for the Review and Modernisation of Further Education and Training (RAM) elaborated on this definition by including in their rationale for learning of Mathematics and Mathematical literacy in the FET band the following:

> "Problems of the real world are translated into variables and relevant operations for which solutions are found. These solutions are then translated into physical entities and tested in the real world." (DoE, 2000: 5).

This requirement of "problems of the real world" points in the direction of the use of contexts in school mathematics. The use of contexts in Mathematical Literacy is further noted in the Learning Programme Guidelines: Mathematical Literacy with statements such as "learners will be provided with opportunities to engage with real life problems in different contexts" (DoE, 2005: 7). Thus the interest in using contexts in Mathematics and Mathematical Literacy is high on the agenda in South

Africa. The research reported in this study is driven by this development in school mathematics in South Africa. It is part of a larger multinational project, the Relevance of School Mathematics Education (ROSME) project, which investigates the contexts learners would like to deal with in Mathematical Literacy and literature related to this project will be referenced in various parts of this mini-thesis.

1.2 Motivation

There is a perception that Mathematics is important in school curricula. Mathematics teaching and learning is a worldwide human endeavor which has been studied and researched thoroughly over the years. Globally Mathematics is regarded as a key subject and is perceived as being "useful" in the "real world". This perception is often translated into reasons and/or aims for the teaching of Mathematics.

The Department of Education , in its Learning Programme Guideline Policy Document, (DoE, 2005: 7) expresses the following view about Mathematics in Further Education and Training (FET):

> It is a distinctive human activity practiced by all cultures. Knowledge in the Mathematical sciences is constructed through the establishment of descriptive, numerical and symbolic relationships. Mathematics is based on observing patterns, which, with rigorous logical thinking, leads to theories of abstract relations. Mathematical problem solving enables us to understand the world and make use of that understanding of our daily lives.

Mathematics is also viewed as an instrument to assist in the transformation of society in South Africa. The DoE (2005: 7) considers Mathematics to be valuable for the country because Mathematics provide powerful conceptual tools to:

- Analyse situations and arguments;

- Make and justify critical decisions and ;
- Take transformative action, thereby empowering people to:
    - Work towards the reconstruction and development of society.
    - Develop equal opportunities and choice.
    - Contribute towards the widest development of society's cultures, in a rapidly changing technological global context.
    - Derive pleasure and satisfaction through the pursuit of rigor, elegance and the analysis of patterns and relationships.
    - Engage with political, organizational and socio-economic relations.

Having been a Mathematics teacher for 19 years and serving as a curriculum adviser for the Western Cape Education Department (WCED) for 5 years, I became aware of the fact that many learners regard Mathematics to be irrelevant and not applicable to their daily lives. The following are comments from learners that I can recall from my experiences in the classroom:

> "Why are we doing this –it is not going to help me in my future career!"
>
> "I cannot do Mathematics because it is only the clever learners that are allowed to do Mathematics and it is a difficult subject."
>
> "The mathematics teacher cannot explain the stuff clearly and only concentrate on those who can."

Barnes (2006: 3) notes that there are propositions and speculations about the causes leading to negative and unpopular images of Mathematics. In particular he mentions teachers' attitudes, the formal nature of most Mathematics teaching and the seemingly lack of relevance of Mathematics to everyday contexts as causes for the perceived negative attitudes from learners, parents and even fellow teachers about Mathematics.

It is because of these types of remarks as well as the research focussing on contexts preferred by learners and teachers that the Relevance of School Mathematics Education (ROSME) project was embarked upon. Literature reveals that teachers' preferences for contexts as the basis for debate is at most an under-researched area as noted by Julie (2006). Julie did a search of data bases and web-trawling by using key phrases as indicated in table 1.1.

Table 1.1: Sentences and key phrases used in data base and web-trawl search

	Sentence/phrase used
1	Teacher interest in context for mathematical Literacy
2	Perceptions of context for Mathematical Literacy by teachers
3	The use of context in Mathematics by teachers
4	Teachers' motivations for using context in Mathematics
5	Teachers' preferences of contexts to be used in Mathematical Literacy
6	Perceptions of teachers of the use of context in school Mathematics
7	Attitudes of teachers towards the use of contexts in school Mathematics
8	Interest of teachers in the use of contexts in school Mathematics
9	Teachers, contexts and Mathematics
10	Mathematics in context by teachers
11	Views of teachers of Mathematics in context

(Julie, 2006)

Julie reported that the above phrases did not produce any hits on the data bases and the web. Similar searches of key journals, conference proceedings and other related literature dealing with Mathematics education produced a similar outcome. The literature on the other hand, indicates a trend towards context-based Mathematics education in South Africa specifically with the introduction of

Mathematical Literacy in the NCS. This study makes similar assumptions as Julie (2006) in that knowledge and understanding of teachers preferences of contexts would benefit the designers of the curricula. Research into the teacher preferences for context will contribute towards narrowing the perceived gap between the designed curriculum, the perceived curriculum and the delivered curriculum in Mathematics Education.This study deals with the issues and situations those teachers would prefer to be included in the Mathematics curriculum.

As will be stated in the next section, a comparison of the contexts preferred by teachers from an East Asian country and their cohort from South Africa will be made and a brief description of grade eight learner performances will be presented. The Trends in International Mathematics and Science Study (TIMSS) delivered results that indicate that the East Asian Countries have been outperforming their Western counterparts in the comparative studies of the performance of eight-graders in Mathematics. TIMSS was developed by the International Association for the Evaluation of Educational Achievement (IAE). It was administered for the first time in 1995. TIMSS provides participating countries with an opportunity to measure students' progress in Mathematics and Science on a regular 4 year cycle. The following table (table 1.2), represents an extract of the results of the average Mathematics scores of eight-graders in TIMSS for the years 1995 to 2003.

Table 1.2: Differences in Mathematics scale scores of Grade 8 learners 1995 - 2003

Grade 8	Year	1995	1999	2003	No of countries participating
	COUNTRY	Average scores			
	Singapore	609	604	605	

Top 5 Countries	South Korea	581	587	589	34
	Hong Kong	569	582	586	
	China(Taipei)	-	585	585	
	Japan	581	579	570	
Bottom 5 Countries	Indonesia	-	403	411	
	Tunisia	-	448	410	
	Chile	-	392	387	
	Philippines	-	345	378	
	South Africa	-	275	264	

TIMMS 2003

Table 1.2 indicates:

(a) that the grade 8 learners from East Asian countries are the top performers in the TIMSS comparative study.

(b) that grade 8 learners from South Africa have been the worst performers in the TIMSS study.

According to Stillman (1998) there is evidence that the classroom practice of teachers is related to their beliefs about Mathematics teaching. Stillman also refers to other studies which call for the reconsideration and reconceptualisation of beliefs about Mathematics teaching needs to be done if significant change in teaching practice were to be effected.

Against the above narrative, the data produced by TIMSS and given the fact that the teacher is a significant factor influencing learner achievement, it was decided to investigate the perspectives of teachers about the contexts to be used in school mathematics.

1.3 Aim of the research

This research seeks to investigate the similarities and differences of the contexts in school mathematics that practicing teachers in South Africa and South Korea prefer learners to deal with.

1.4 Research questions

The two research questions of this study are:

(i) What are the contexts that South African and South Korean teachers of Mathematics prefer to be dealt with in Mathematics?

(ii) Are there significant differences or similarities between the contexts preferred by the two cohorts of teachers?

1.5 Organisation of the study

In this chapter some background and the motivation for the study was provided. Pivotal in the motivation for this study is the high performance of learners from East Asian countries with the contrasting underperformance of learners from South Africa in the TIMSS 2003 report. Given the fact that the Mathematical Literacy in the NCS paves the way for different contexts to be used in the curriculum, it is important to get a sense of the contexts teachers prefer to be included in the curriculum.

Chapter 2 deals with the theoretical framework where concepts such as contexts, content and relevance are discussed by making use of a literature review.

The research methodology is dealt with in chapter three whilst chapter four is about the research findings. Finally a discussion of the study and recommendations for further study are made in chapter five.

CHAPTER 2

CONTEXTS IN SCHOOL MATHEMATICS

In chapter one it was stated that this study will focus on the contexts that teachers from South Korea and South Africa prefer to be included in school mathematics. The use of contexts in school mathematics has always been approached from the notion of applications of Mathematics. These applications were normally given after a particular content strand has been covered. For example, if quadratic theory was dealt with, the solution to quadratic equations would be followed by something such as “problems leading to quadratic equations” which would typically be a word problem set about a real world situation. The syllabus provided to teachers was written in a prescribed sequence and contained the content to be taught. One of the TIMSS evaluators, B. Schmidt, is quoted by Leung et al. (2006; 362) as suggesting that there needs to be a re-evaluation of the way in which content is presented to learners. In the following paragraph content is discussed.

2.1 Content

Content refers to the Mathematical topics to be covered by the curriculum. There are very few documented research findings covering the content to be taught. Haertel, Walberg and Weinstein (1983) are quoted by Romberg and Carpenter in Wittrock (1986: 861) as having found eight models containing a “quality of instruction” component associated with a discussion of content. Romberg and Carpenter identified one model by Harnischfeger and Wiley (1975) which suggested that the structure of the material to be learned has an influence on the organisation, complexity, pacing and clarity of instruction of the task to be done. (Wittrock, 1986: 861). Noting that none of the research models specified the structure of the content to be learned, Romberg and Carpenter conclude that most studies on Mathematics teaching are too global.

The nature of the content of the curriculum is determined by the educational authorities. In a centralised education system it will be uniform for all schools within the country. In the case of a decentralised system, it might be different between schools situated in different areas of the federation of states as is the case in the U.S.A. In South Africa the content is determined by the Department of Education (DoE) and disseminated to the Provinces in the form of a Curriculum Statement. The Provinces in South Africa have executive powers for educational matters and can "provincialise" the content within the framework of the National Curriculum Statement (NCS).

In the introduction to the "provincialised" interim syllabus of 1996 for Mathematics in the Junior Primary Phase (Gr. 1- 3), the Western Cape Education Department stated that:

> This syllabus is aimed at fostering and developing the following societal aims:
>
> - To work towards the reconstruction and development of the South African society and the empowerment of its people;
> - To develop equal opportunity;
> - To contribute towards the development of the society's cultures;
> - To encourage democratic, non-racial and non-sexist teaching practices;
> - To create an awareness of and responsibility for the protection of the total environment. (WCED, 1996: 1)

This syllabus distinguished between non-contextual problems eg.

4 + 3 = [ ] or 6 + 7 + 4 = [ ]

and contextual problems defined as:

> A variety of carefully selected and well-formulated problems, based on real situations are posed on a regular basis for learners to solve. Learners should be able to identify themselves with the problem situation to enhance visualization, interpretation and full understanding, which will lead to feasible solutions. (WCED, 1996: 31).

The Western Cape Education Department identified the use of logical processes to solve problems and the demonstration of an understanding of the historical development of Mathematics as social/cultural contexts in Mathematics. (WCED, 2001: 13).

Romberg and Carpenter, in Wittrock (1986), have listed various researches having been done on features that influence the judgment of teachers. These factors are however beyond the scope of this study and I would like to draw the reader's attention to the conclusion that Romberg and Carpenter arrived at viz.:

> Together these studies demonstrate that teachers' behaviors are influenced by rational and reflective actions. Their plans and what influences their thinking and decision making, however, are not based on considerations of what is to be taught. (Wittrock, 1986: 864).

2.2 Contexts

Context is defined in the Concise Oxford Dictionary (1981) as: *ambient conditions or surrounding conditions (ambi = both sides ; ire = go)*. Various studies have been conducted about the use of contexts in school mathematics. These studies essentially concerned themselves with effects of the use contexts on learners' mathematical ability as indicated by Julie (2007). This, however, is not the focus of this study and will thus not be delved into.

Boaler (1993:14) recognises two reasons for learning in contexts viz.:

(a) Concerning the motivation and interest of learners through an enriched and vivid curriculum.

(b) Concerning the enhanced transfer of learning through a demonstration of the links between school mathematics and real world problems.

Busse and Kaiser (2003) noted work done by Clarke and Helme (1996) where a distinction has been made between figurative context and interactive context. Figurative context has been described by Clarke and Helme as the situation described in a task whilst the interactive context as the context in which a task is encountered. According to Busse and Kaiser (2003; 4) interactive context comprises the real scenario a task is imbedded in whilst figurative context describes how the context is perceived by the student. According to Busse and Kaiser (2003) both kinds of contexts are individually constructed and they distinguish between:

- Objective figurative context which is a description of the real scenario in the task and:
- Subjective figurative context which is an individual interpretation of the objective figurative context.

As result of these assertions from mathematics educators, many current mathematics schemes present mathematics “in context” These deliberations also indicate that “experiences of situation and context are a consequence of a process of construal” (Clarke and Helme, 1998: 130). Given that context thus changes as it experienced by learners and it can be said also by adults, it is conceivable that contexts are aligned with culture and interests of the perceiver. A discussion about the influence of culture on Mathematics Education follows.

2.3 Culture

Leung (2006), in Leung et al, noted an apparent paradox when he analysed the TIMSS results. East Asian learners scored high in this international comparative test. This superior performance in Mathematics according to Leung was, however, not accompanied by correspondingly positive attitudes towards Mathematics. Leung also executed an analysis of the teachers and noted differences in teacher attitudes and teaching styles between East Asia and the West. According to Leung East Asian teachers prefer procedural styles of teaching. (Leung et al, 2006: 30). Given this preference for procedural modes of teaching it is conceivable that East Asian teachers might prefer different contexts than South African teachers. This study is concerned with investigating this assertion. Furthermore, Leung's study deals with developed countries in the West and East Asia. There is thus a gap in research regarding differences or not about attitudinal issues between developed West or East Asian countries and late developing countries. This research is situated within this gap by specifically focusing on one East Asian country, South Korea, and a late developing country, South Africa. Instead of using the TIMMS data as Leung has done, this study further focuses on one issue not dealt with in the TIMMS study, the contexts teachers would prefer school Mathematics to be embedded in.

2.4 The situation of contexts in school mathematics from disciplinary domain perspective

Although currently much is written about contexts in school mathematics, very little is said about the disciplinary domain within which contexts are in the foreground. In stating that "Mathematical Literacy is embedded in mathematical modelling and applications." Julie (2006) is unambiguous about the exact disciplinary domain within which contexts are primarily situated. This disciplinary domain is mathematical modelling and the applications of mathematics and what follows is a review of this domain as it pertains to school mathematics

2.4.1 Relevance of Mathematics

Contexts are inextricably linked to the deliberations on the relevance of mathematics and Niss (1985) indicated that the problems in mathematics instruction gave rise to the demands of relevance. Relevance was interpreted by those involved as *applicability* (his emphasis) ranging from specific sectors and societal professions to school subjects and students' daily lives. In his historical retrospect of the applications and modelling in the mathematics curriculum, Niss notes that applications were taught in Mesopotamia centuries ago and that after World War 2, there was a momentum of reform of mathematics curricula called the "new math" aiming at improving and modernising the curricula at all levels. The important point noted by Niss is the fact that from the "new math" movement, a few proponents were convinced that Mathematics would be a powerful tool for understanding extra-mathematical problems because the fundamental structures of Mathematics provides a structural framework enabling people to analyse unstructured situations. Swetz (1991) is in accordance with Niss when he states that students should be able to *"apply the process of mathematical modelling to real-world problems."*(p. 37). Lesch (1980: 13) sounds a warning related to relevance by stating that:

> We teachers worked hard to select good problems from books on consumer math, business math and other topics that people today might associate with Mathematical Literacy or basic skills. We thought that the students would love the course because it was so

relevant. All the lessons were centered on real-life problem situations. – They hated it … Our ideas about real-world problem situations were not necessarily wrong. But our ideas about the real world were somewhat different from our student's ideas.

Lesch draws attention to how contexts perceived as relevant by one group may not be accepted as such by another group. This is further support for this study in that one can get a sense of the contexts that teachers in different cultural contexts prefer to deal with.

2.4.2 Mathematical modelling and the applications of Mathematics

In his focus on post-elementary curricula, Niss (1985: 493 – 498) defined the following five structural phases characterising the development of applications and modelling in Mathematics.

(a) Zeroth Phase: Characterised by the attention given by educators and educationalists to the issue of applying Mathematics.

(b) First Phase: Applications were treated as another topic in the syllabus with closed exercises.

(c) Second Phase: Characterised by the realization that students should acquire the ability to activate Mathematics themselves.

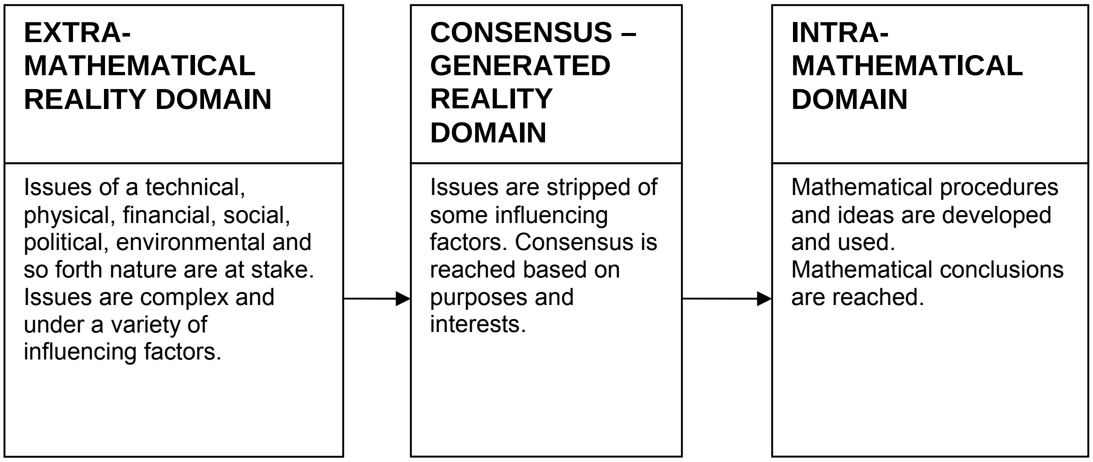
(d)Third Phase: This phase according to Niss (1985: 497) is characterized by the phenomenon that the Mathematics that is used in the process of model building depends on the nature of the field of application.

(e) Fourth Phase: This phase is characterised by the gap between the debate on the development of modelling and applications in Mathematics and the mainstream mathematics instruction. This phase is also characterised by the marked different levels of development in different institutions and different countries.

Niss concluded that in most countries, however, there are developments of applications, models and model building in post-elementary curricula. South Africa is according to my estimation in the second phase, which according to Niss requires that students build models related to situations from the world surrounding them. The term "modelling", on the one hand, focuses on the relation *reality* → *Mathematics* and, on the other hand and more generally, emphasizes the processes involved. (Blum and Niss, 1991: 38). The term "application", on the one hand, focuses on the opposite direction *Mathematics* → *reality* and, on the other hand and more generally, emphasizes the objects involved – in particular those parts of the "real" world which are accessible to a mathematical treatment and to which corresponding mathematical models exist. (Blum and Niss, 1991: 38). Applications and modelling has been used to refer to all kinds of relationships between the "real" world and Mathematics and thus to the use of contexts in Mathematics.

Mathematical models provide the setting in which Mathematics is applied according to Kerr and Maki (NCTM, 1979: 1). In essence there are three domains involved in mathematical model making. These are the extra-Mathematical reality, the consensus-generated reality domain and the intra-Mathematical domains. The characteristics of these domains are reflected in figure 2.1 below as outlined by Julie (2004).fig 2.1:

Fig 2.1 Domains in Mathematical model making



Various diagrammatic representations of the mathematical modeling process exist.

Corbett and Edwards (NCTM, 1980:217) are of the opinion that the process of mathematical modelling involves three steps viz.

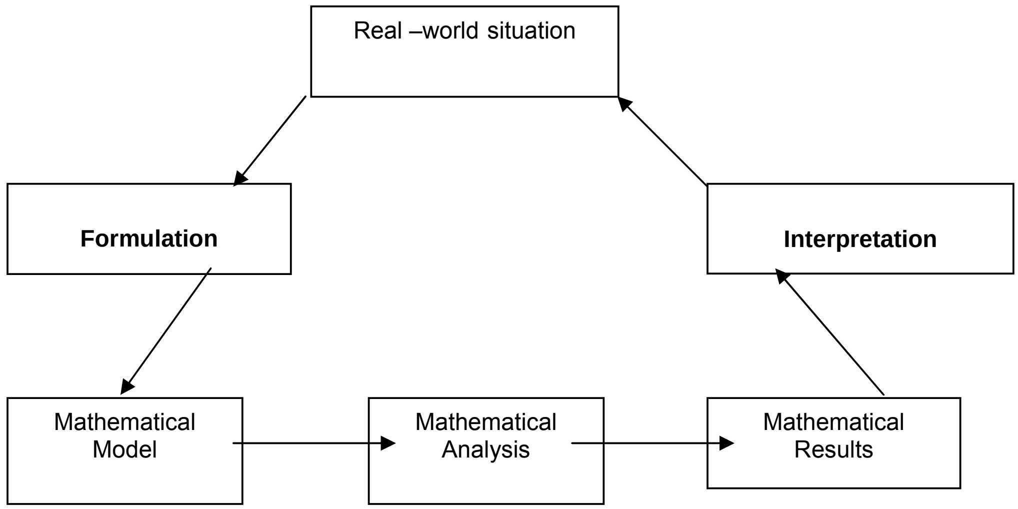
(a) The formulation of a real-world problem in mathematical terms, thus constructing of a mathematical model.

(b) The analysis or solution of the resulting mathematical problem.

(c) The interpretation of the mathematical result in the context of the real-world situation.

This process can be expressed by figure 2.2. on page 18.

Fig 2.2 Process of mathematical modelling



This diagram illustrates that mathematical modelling is a powerful instrument of communication between the real world and the mathematical world and is one of several ways of solving real problems. The question now arises as to how do we apply Mathematical modelling in our practice?

2.4.3 Incorporation of modelling and applications in school mathematics

In 1980 a need for modelling in the Mathematics Curriculum was identified by the National Council of Teachers of Mathematics (NCTM). The history of South African curriculum development also indicates the need for modelling arose more than two decades ago when applications was part of the intended curriculum. In South Africa some form of Mathematical modelling was implemented in 2006 with the introduction of the FET curriculum, after the People’s Mathematics project more then a decade ago argued that for a Mathematics curriculum to be emancipatory and empowering, it must be applications-based according to Julie (2004).

Swetz (1991: 358) is of the opinion that the challenge for teachers is to understand the process of mathematical modelling and to apply it effectively in problem solving. According to Swetz the word model implies something that can be manipulated and that lends itself to experimentation.

Mathematical modelling can be incorporated in many ways. Separate courses or sections of a course devoted exclusively to mathematical modelling are not necessary. The separation or isolation of mathematical modelling from the rest of the Mathematics curriculum tends to raise the suspicion in the minds of students that mathematical modelling is something unusual or difficult. A modelling approach to problem solving and modelling theory should be incorporated gradually in a low-key manner into the existing curriculum. Many of the problem situations and relevant Mathematics are already in place; they need only a slightly different solution orientation to become modelling situations according to the NCTM (1991). This position equates mathematical modelling more with problem-solving. The danger of such an approach is that the issue of import or the consideration and resolution of the contextually can be relegated to mere dressing up of a content problem in mathematical language.

With respect to the teaching of mathematical modeling and applications De Lange et al (1993) states that teaching is often interpreted as an activity which is mainly carried out by the teacher – they introduce the subject, give one or two examples, may ask a question or two, and will encourage students who have been passive listeners to become active. It is not unusual that this ‘activity’ is carried out in an individual way for most of the time. The lesson will be ended in a well-organised way, the ‘closure’ and the next lesson will be carried out along similar lines. Using real problem situations in Mathematics education makes teaching more complex. The teacher is no longer supposed to teach, but learning the art of ‘unteaching’ has proved to be very difficult and very personal. The teacher’s role is that of organiser and facilitator. The process cannot be described in detail for every teacher – they need to make their own personal adaptation. To make things even more difficult, the teacher faces additional obstacles, such as problems that have several different answers, or one answer and several different strategies.

The different strategies often involve more than one level of mathematical thinking, which forces the teacher into a discussion about the values of the strategies. Although the educational value of such a discussion can be considerable, it will make life for the teacher even more complex. Sometimes students come with very elegant solutions, not envisaged by the teacher. In this situation it is not always easy to react properly – the teacher has to make a judgment about the solution, to react on it, and to reflect whether or not they should still show their own solution. It will come as no surprise that teachers feel insecure in these situations, and sometimes even feel that they have to face a loss of authority because a student has outsmarted them which, under certain conditions, can be a threatening situation as asserts by De Lange (1993).

Applied Mathematics, applications of Mathematics and Mathematical modelling are at times used as synonyms. There appears to be a converging consensus that splitting hairs of separability is counter-productive since whether it is applications or modelling or applied Mathematics the outcome is always a mathematical model relevant for some purpose, as stated in the class notes (2004).

2.5 Mathematical Literacy

The concepts Mathematics and Mathematic Literacy have different meanings for different people. The differences in meaning also appear between different countries. Evans (2000), quoted by Hoogland (2003) defines Mathematical Literacy as: “the ability to process, interpret and communicate numerical, quantitative, spatial, statistical, even mathematical information in ways that are appropriate for a variety of contexts and that will enable a typical member of the culture or subculture to participate effectively in activities that they value.”

Jablonka et al (2003: 75 – 102) is of opinion that Mathematics refers to the numerical nature of Mathematics whereas Mathematical Literacy entails a broader approach of Mathematics with the understanding that the target audience is a group of individuals with a sound educational background. Pugalee (1999: 19 – 22) underscores the situation by stating that “Both in the United States and abroad, the task of creating a coherent vision of what it means to be Mathematical literate has not been sufficiently realised.” Pugalee proposed that a basic model of Mathematical Literacy should include the following five processes through which students (learners) obtain and use their Mathematical knowledge:

(a) Valuing Mathematics

(b) Becoming confident in one’s ability to do math

(c) Becoming problem solvers

(d) Communicating Mathematically

(e) Reasoning Mathematically

The official policy documents do however make a distinction between Mathematics and Mathematical Literacy (DoE: 2002) In terms of the South African Qualification Authority’s (SAQA), Mathematics and Mathematical literacy are fundamental subjects. This means that all learners in FET will have to do either Mathematics or Mathematical literacy as prerequisite for the FET certificate.

In South Africa the term Mathematical Literacy refers to the Mathematics being taught at GET level and specifically at the Foundation and Intermediate phases (grades R – 6) as well as at ABET levels 1 & 2. Mathematical literacy in the South African context refers to a subject to be offered at Gr. 10 to 12 in the FET band. In the National Curriculum Statement (2003: 9), Mathematical Literacy is defined as follows:

> Mathematical Literacy provides learners with an awareness and understanding of the role that Mathematics plays in the modern world. Mathematical Literacy is a subject driven by life-related applications of Mathematics. It enables learners to develop the ability and confidence to think numerically and spatially in order to interpret and critically analyse everyday situations and to solve problems.

The same document also refers to Mathematical Literacy as the type of skills learners should possess in a modern society. The two terms are being used interchangeably referring to the same concept at GET level.

Given the definition of Mathematics by the DoE as stated in paragraph 1.2, one can thus conclude that in the South African context, a clear distinction is made between Mathematics and Mathematical literacy at the FET level.

The discussion above leads me to concur with Doyle (1994: 23) when he states that:

> Mathematical Literacy is driven by real-life contexts and should take a high priority in the learning and teaching of Mathematics. Teachers of

Mathematics need to change their teaching strategies to accommodate the interests of their learners.

2.6 Summary and conclusion

In this chapter I have discussed content and context in school Mathematics. The discussion about contexts, relevance, modelling, applications and Mathematical literacy point in the direction that the contexts used in Mathematics are not unproblematic. A concern of this study is developing a sense of the contexts teachers deem appropriate for use in Mathematics. However, the use of contexts can not be isolated from the mathematical domain where contexts feature prominently and are primary object being dealt with. Hence the in-depth discussion of mathematical modelling and applications. As will become evident in chapter 3, this disciplinary base was a major feature for the development of an appropriate instrument for data collection.

CHAPTER 3

RESEARCH METHODOLOGY, INSTRUMENTATION, SAMPLING AND DATA

3.1 Introduction

This chapter deals with the research methodology used. To determine the context preferences of South African and South Korean teachers, survey research was used. A description of the research instrument followed by a discussion of the sampling, data collection process, the data coding process as well as the analysis process will be discussed.

3.2 Research methodology

The study employed the cross-sectional survey research methodology. This methodology entails the collection of data by using a questionnaire. The questionnaires are instruments containing predetermined questions for the respondents to fill in themselves. According to Biddle and Anderson in Wittrock (2003: 231), questionnaires present a set of stimuli to the respondents which cannot be varied in the light of the responses.

There are advantages as well as disadvantages in using the survey method of research and I am highlighting some of these below.

3.2.1 Advantages of the survey method

Simon (1969: 191) mentions that:

1. With a survey, a researcher can get closer to the “real” hypothetical variables than with laboratory experiments. 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 internal reliability. Such huge samples are seldom available in experimentation.

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.

3.2.2 Disadvantages of the survey method

According to Simon (1969: 192), the major disadvantages of the survey method are:

1. 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 multivariate causation, especially when two independent variables are themselves highly associated.

Biddle and Anderson in Wittrock (2003: 232) also allude to the fact that questionnaires demand literacy on the part of the respondents. This means that it cannot be administered to young children or respondents who are not fluent in the language in which the questionnaire is written.

Because of the nature of this study, it was decided that the survey method would be employed in the light of the strengths mentioned in 2 and 3 of the advantages of surveys above and taking into account the warning given by Biddle and Anderson as stated above.

3.3 Instrumentation

The questionnaire used to survey the contexts teachers would prefer to be used in Mathematics was extracted from the ROSME questionnaire to ascertain the contexts learners prefer to be used in Mathematics. Julie and Mbekwa (2005: 33) describe the development and piloting of the learner questionnaire as follows:

> …a survey instrument was developed around identified topics or clusters. The clusters were identified by mathematics educators from South Africa, Zimbabwe, Uganda, Eritrea, Norway and a group of mathematics teachers from South Africa. Thirteen clusters including two intra mathematical ones evolved through the identification process. The identification of the eleven extramathematical clusters was in a major way informed by modules and learning materials developed by the Consortium for Mathematics and its Applications … to ensure compliance with the possible mathematical treatment of the cluster items which were developed as indicators of the identified clusters.

They also explain the procedures and decisions undertaken to ensure that learners concentrate on contexts and not on mathematics, an inherent problem of instruments targeting a specific issue in a well-established school subject domain. They report that “The instrument was constructed with careful attention given that learners make a personal response.” And that the inherent difficulties “appears not have detracted overall from learners responding the way they did.” (Julie & Mbekwa, 2005: 34). With regard to the final learner questionnaire Julie (2007: 197) further reports that

> The extra-mathematical clusters, with the number of items per cluster in brackets, decided upon through competitive argumentation were: Health (4), Physical Science (3), Technology (5), Transport and delivery (3), Life Science (3), Crime (4), Sport (2), Youth Culture (4), Politics (3), Agriculture (4)

and General (7). A guiding criterion in deciding the elements belonging to a cluster was conceptual consistency.

As mentioned earlier the teacher questionnaire was extracted from the learner questionnaire and Julie (2006: 51) asserts that “The teacher instrument comprised of twenty items given…and contained items from all the contextual categories used in the learner questionnaire.”

The instrument for determining the teachers’ preferences comprised of two sections namely:

(a) A section 1 containing twenty items given in appendix 1. In this section teachers were asked to indicate their preference on a four point Likert-scale with the score “1” indicating strongly disagree, “2” indicating disagree, “3” indicating agree and “4” indicating strongly agree. The data thus received were ordinal and reflected a clear ordering of variables. The items were of two types viz.:

   i. Intra-mathematical items related to Mathematics per se. The items T8, T15 and T19 were considered to be of an intra-Mathematical nature.

   ii. Extra-mathematical items based on contexts and relating to issues where Mathematics can be applied

(b) A second section containing two items where the teachers were asked to :

   i. Identify three items they marked with “4” from the previous list of twenty and give reasons for their wanting learners to learn about these items.

   ii. Identify three items from the list of twenty that they least likely agree with and to provide reasons for their not wanting these items to be included in their Mathematics classes.

This mini thesis is concerned with the data obtained from (a) because analysis of section (b) has to be qualitative in nature and more of a hypothesis-generation nature thus falling beyond the focus of this study. However, excerpts from section (b) are used to support statements made in the discussion.

The ROSME questionnaire was developed in English in South Africa and the Korean version of the questionnaire was based on this version. The English version was translated by a Korean Master's student into the Korean language and checked for correctness by a Korean Mathematics teacher. The second version in the Korean language was modified by another Korean Mathematics teacher and finally crosschecked with the English version in January 2005 according to Kim (2006: 80).

3.4 Sample

As is the case with most research involving teachers, except large scale state-supported research, the South African teachers were sampled conveniently. Julie (2007) describes the South African sample as "teachers attending continuing professional development teacher education courses at the university" and teachers at schools where students involved in the master's programme in Mathematics Education were teaching and those in schools surrounding their schools. Two hundred questionnaires were distributed to this cohort of students.

In South Africa, the teachers taught primarily in schools serving low socio-economic status (LSES) learners in urban and peri-urban regions the Western Cape province of South Africa. The sample included teachers not teaching Mathematics. The reason for including non-Mathematics teachers was to broaden the base of responses and to afford them the opportunity to express their opinion about Mathematics teaching .

Sampling in South Korea followed the TIMSS process. The South Korean teachers taught in metropolitan and rural areas. According to Kim (2006), data was collected from 21 schools in the regions from Seoul, the capital city, to poverty stricken rural and island areas. The regions were classified into three clusters. For the selection of schools in each region, simple sampling was employed (Kim, 2006; 69). Sixty questionnaires were distributed in South Korea from teachers teaching in schools where the learner questionnaire was administered. The total number of questionnaires returned and other demographic data are presented in table 3.1.

Table 3.1: Demographic data of samples.

CRITERION		South Africa			South Korea		
		ACTUAL	MISSING	TOTAL	ACTUAL	MISSING	TOTAL
Female		60	2	149	19	1	60
Male		87			40		
Age	Years		14	149		2	60
	< 30	9			8		
	31-40	80			9		
	41-50	40			22		
	> 50	6			19		
Teaching Experience	< 10	29	6	149	9	3	60
	11-20	89			24		
	> 20	25			24		
Teaching subjects	Mathematics	36	5	149	32	1	60
	Language	25			10		
	Other	70			17		
	All Primary subjects	13			0		

3.5 Data collection

In South Africa the data were collected by the research leader, his colleagues at the university and the students following the master's degree programme in Mathematics Education. The data collection in South Korea was overseen by the Korean masters' student who traveled to South Korea to collect the data.

The completed questionnaires were returned to the research base at UWC. The data were captured as SPSS files, one for the South African and one for Korean cohort. After capturing the data were by basically checking whether there were no out-of-bound entries. In compliance with raw data storage procedures, the original completed questionnaires were stored at the research base at UWC for scrutiny to settle disputes about the authenticity of the data.

3.6. Comparison of data

To enable me to make comparisons with regards to the teaching of different subjects, table 3.2 was constructed from the data provided in table 3.1. Table 3.2 represents the percentage of teachers teaching Mathematics, Language and other subjects.

Table 3.2: Percentage teachers South Africa and South Korea: Teaching subjects.

Subjects	South Africa	South Korea
Mathematics	24.2	53.4
Language	16.7	16.7
Other	46.9	28.3
All primary subjects	8.7	0

Table 3.2. indicates that more of the South Korean teachers are Mathematics teachers. In both cohorts the same percentage of teachers are teachers of language.

The data suggests that the South African cohort presents a wider spectrum of teachers involved in teaching other subjects. The teachers from the South Korean cohort do not teach primary school subjects whereas 8.7% teachers of the South African cohort are involved in teaching primary school subjects.

At a global level there are other differences between teachers in South Africa and South Africa. These differences are discussed below and the discussion is based on the data collected for the TIMSS 2003 study.

Table 3.3 Current requirements to be a teacher

Aspect of teachers preparedness	South Africa	South Korea
Pre-practicum and Supervised practicum	Yes	Yes
Passing an examination	Yes	Yes
University degree or equivalent	No	Yes
Completion of a probationary teaching period	Yes	No
Completion of an induction programme	No	No

TIMSS (2003)

The most remarkable difference between the South Korean and South African preparation of Mathematics teachers lie in the fact that a University degree or equivalent is necessary in Korea. One deduction to be made is that the Korean educators are perhaps more “au fait” with the theoretical knowledge of the subject than their South African counterparts. On the other hand, the South African system has a compulsory probationary system in place. How effective this system is can be questioned. My experience in practice is that the probationary period is merely a legal and administrative requirement and that no real assistance is given to the beginner teacher during the first year of his/her career. Permanent appointment status follows after completion of the first uninterrupted 15 months experience in the class on condition that no serious behavioral problems are reported to the employer.

Table 3.4 Mathematics teachers' Gender, Age, Certification and Number of years teaching

Categories		Percentage of students by teacher characteristics		
		South Africa	**South Korea**	**International Average**
Gender	Male	60	33	58
	Female	40	67	42
Age	39 years and younger	19	17	30
	30 – 39 years	55	13	30
	40-49 years	21	35	30
	50 years and older	5	7	23
Qualification level	Full Certificate	45	98	88
Experience	Number of years Teaching	11	13	16

TIMSS (2003)

The following trends can be seen from the data depicted in table 3.4.

(a) That 60% South African learners are taught by male teachers against 33% of South Korean learners.

(b) That the majority of South African Gr. 8 Mathematics learners are taught by teachers younger than 40 years (76%) whilst their South Korean counterparts with the majority of the South Korean learners are taught by Mathematics teachers older than 40 years.

(c) That almost all the learners from South Korea (98%) are taught by teachers with a full certificate against less than half of the learners from South Africa (45%) being taught by teachers with a full certificate.

Table 3.5 Highest educational level of Gr. 8 Mathematics teachers.

Categories	Percentage of students by their teachers' educational level		
	South Africa	South Korea	International average
Beyond Initial University degree	10	25	17
Finished University or equivalent	24	75	59
Finished post Secondary Education but not University	61	0	20
Finished upper Secondary schooling	5	0	4
Did not complete upper Secondary schooling	0	0	0

TIMSS (2003)

From table 3.5 the deductions can be made that the majority of South African Gr. 8 learners (61%) are taught by teachers who do not have a university degree whilst all learners in South Korea are being taught by teachers who have at least finished University or an equivalent qualification. The percentage of South African learners being taught by non-graduate teachers is also higher than the International average. The percentage of South African learners who receive Mathematics classes in Gr. 8 from teachers who have just finished upper secondary schooling is higher than the International average whilst there are no teachers who teach Mathematics in South Korea who have not finished a University or equivalent qualification.

3.7 Data analysis procedure

As this study concerns itself with preferences of teachers, the responses to the questionnaire are subjective in nature and are determined by the likes and dislikes of people. The responses to the questionnaire were, as indicated above, given as a choice on a scale according to the degree of agreement with some statement. Because the difference between a "1" (strongly disagree) and a "2" (disagree) cannot be assumed to be the same as the difference between "2" (disagree) and "3" (agree) the data are considered to ordinal in nature. This type of data cannot be measured, for example degree of pain or in the case of this study, the degree of agreement of people. The distance between each scale step is not important, only that there is an order between them. The scale used in this study is called an ordinal scale and specifically the rank-order scale. Nonparametric statistical procedures are deemed appropriate for analysing ordinal data.

According to Field (2005;521) many nonparametric tests are based on ranked data by ordering from lowest to highest and then being assigned integer values in that order from 1 to some value decided by the researchers. Nonparametric analysis has advantages in comparison to parametric methods for ordinal data. According to Triola & Franklin (1995; 658) the advantages of nonparametric methods are:

(a) Nonparametric methods do not require assumptions about the nature or shape of the populations involved.

(b) Unlike parametric methods, nonparametric methods can also be applied to nominal data that lack exact numerical values.

(c) Nonparametric methods usually involve computations that are simpler than the corresponding parametric methods and are therefore easier to understand.

The statistic used for the analysis of the data was the Kendall W Test. The Kendall W Test is also known as the coefficient of concordance which can be interpreted as a coefficient of agreement among raters. The mechanical calculations were done by using a computer software programme called Statistical Package for the Social Sciences (SPSS) version 13.2. Each case (row in SPSS language) is a rater and each variable (column) is an item being rated. The coefficient W ranges from 0 to 1, with 1 indication complete inter-rater agreement and 0 indicating complete disagreement among raters. The SPSS programme accorded mean ranks to the responses from the teachers. The data was exported to an Excel file for further manipulation and the construction of the tables and graphs which are presented in tables 4.1 and 4.2. Using the Excel format, the results from the Kendall Test were sorted in ascending order and will be discussed as findings of this study in the fourth chapter.

3.8 Validity and reliability

Validity is defined by Dawson & Trapp (2004; 414) as the measure of how well an instrument measures what it purports to measure. They distinguish between the following measures of validity for a test or questionnaire:

a) Content validity: the degree to which items on the instrument are representative of the knowledge being tested.
b) Face validity: The degree to which a questionnaire or test appears to be measuring what it is supposed to be measuring.
c) Criterion validity: the capacity of the instrument to predict a characteristic that is associated with the characteristic.
d) Construct validity: demonstration of the relatedness of an instrument to other instruments that assess that same characteristic and the non-relatedness to instruments that assess other characteristics

The processes engaged with the development of a team of experts (mathematics educators from various countries) and post-graduate students in Mathematics Education, the embeddedness of the items in a particular disciplinary domain and the piloting ensured the content and face validity as enunciated above.

The reliability of this instrument was tested as reported by Julie, Holtman and Mbekwa (2007). They used the Rasch modelling procedure and report the person reliability to be 0,78. Person reliability, according to the Rasch model, is a measure which is equivalent to 'test' reliability. Julie,Holtman and Mbekwa also found the item reliability to be 0,91 which, according to them gives a high level of support that the hierarchical ordering of the twenty items will be replicated with a different sample teaching in a similar context as the respondents.

3.9 Summary

This chapter dealt with a description of the survey as a research methodology employing a questionnaire as the research instrument. This was followed by a discussion of the ROSME questionnaire as well as a description of the collected data as ordinal data. Following the data description is a section on the using of a computer software programme (SPSS) enabling researchers to apply the Kendall W test to the data and manipulate the result in Excel format for interpretation. Finally a comparison of the sample of this study and a sample of Grade 8 teachers from the TIMSS (2003) report was made to be used as reference when the findings of this study are made as described in chapter 4.

CHAPTER 4

FINDINGS

This chapter deals with the findings and trends with regards to the research question "Are there differences in the contexts preferred by South African and South Korean teachers of Mathematics?" Data were treated as described in 3.6 above.

4.1 Analysis of Kendall Ranking

The Kendall W test was applied to the data and the mean ranking (ranked in order from lowest to highest) for each of the two cohorts from South Africa and South Korea were determined and is given in table 4.1.

Table 4.1: Ranking of items by South African and South Korean teachers:

South African teachers	
Test Items	**Kendall mean ranking**
T20	6.05
T11	6.43
T18	8.02
T3	8.82
T16	9.54
T5	9.71
T2	9.79
T4	10.29
T1	10.58
T9	10.71
T15	10.75
T17	11.11
T14	11.49
T7	11.64
T19	11.86
T13	11.9
T12	12.27

South Korean teachers	
Test Items	**Kendall mean ranking**
T11	7.56
T18	7.81
T20	7.9
T3	8.56
T15	8.62
T9	8.8
T2	9.27
T5	10.06
T16	10.56
T1	10.84
T4	11.1
T10	11.23
T12	11.24
T17	11.56
T8	11.6
T19	11.99
T14	12.19

T6	12.76
T8	12.95
T10	13.33

T7	12.54
T13	12.6
T6	13.97

Table 4.1 indicates the following:

(a) That the three lowest ranked items by the South African teachers are items 20, 11 and 18. These are items referring to gambling, military matters and disco and rave dancing.

(b) The three lowest ranked items by the South Korean teachers were items 11, 18 and 20. These are items referring to military matters, disco and rave dancing and gambling.

(c) That the three highest ranked items by the South African teachers are items 6, 8 and 10. These items are referring to the Mathematics involved in the making of bridges, airplanes and rockets, Mathematics that will help learners to do Mathematics at universities and technikons and Mathematics involved in health issues such as amounts of medicine and HIV/AIDS spreading.

(d) The three highest ranked items by the South Korean teachers were items 7, 13 and 6. These are items relating to sustainability, emergency services and construction of bridges, airplanes and rockets.

There seems to be a concurrence between the South African and South Korean samples about the three lowest ranked items whilst a difference seems to exist with respect to the three highest ranked test items.

Table 4.2 Differences in Kendall W ranking between South African and South Korean teachers.

	South African Kendal mean rank	South Korean Kendal mean rank	Difference in Kendal mean ranks
T1	10.58	10.84	0.26
T2	9.79	9.27	-0.52
T3	8.82	8.56	-0.26
T4	10.29	11.1	0.81
T5	9.71	10.06	0.35
T6	12.76	13.97	1.21
T7	11.64	12.54	0.9
T8	12.95	11.6	-1.35
T9	10.71	8.8	-1.91
T10	13.33	11.23	-2.1
T11	6.43	7.56	1.13
T12	12.27	11.24	-1.03
T13	11.9	12.6	0.7
T14	11.49	12.19	0.7
T15	10.75	8.62	-2.13
T16	9.54	10.56	1.02
T17	11.11	11.56	0.45
T18	8.02	7.81	-0.21
T19	11.86	11.99	0.13
T20	6.05	7.9	1.85

Table 4.2 yields the following identifiable groups of items:

(a) A group of items where the differences between mean ranks of the South Korean and South African responses are negative. This means that the mean ranks of the South Korean responses were higher than the corresponding mean ranks of the South African responses and that the South Korean teachers attached more value to these items than their South African counterparts.

(b) A group of items where the differences between the mean ranks of the responses from South Africa and those from South Korea were very small.

(c) A group of items where there is a positive difference between the mean ranks of the South Korean and South African responses. This means that the mean ranks of the South African responses were higher than those of the South Korean responses and that the South African teachers thus regarded these items of more importance as their Korean counterparts.

The results of the identification of the three groups of items can be summarized by the data as summarized in table 4.3 below:

Table 4.3 : Comparison of differences in mean ranking between South African teachers and their counterparts in South Korea

$M_{SK} > M_{SA}$	$M_{SK} \sim M_{SA}$	$M_{SK} < M_{SA}$
T4;T5;T6;T7;T11;T13; T14;T16;T17;T20	T1;T3;T18;T19	T2;T8;T9;T10;T15
M_{SK} = South Korean mean rank M_{SA} = South African mean rank		

4.2. Determining the difference between the two populations

To establish whether there is a significant difference between the contexts preferred of the South African respondents and that of the South Korean respondents per item tested, the data from both countries were subjected to the Mann-Whitney U test. According to McCall(1970), the Mann-Whitney *U* test for differences between two independent samples is used to evaluate the differences between the two population distributions (McCall, 1970: 324).

This test is administered under the assumptions and conditions that:

(a) The observations are randomly and independently sampled.

(b) The groups are independent.

(c) The dependent variable is continuous and that the measurement scale is at least ordinal.

The data used in this study satisfies all three conditions above as described in chapter 3.

The scores from both countries were merged into a SPSS data file. As stated in Chapter 3, separate data files were constructed for the South African and South Korean responses. For running the Mann-Whitney test with SPSS, a single file was required and hence the merging of the files. The Mann-Whitney test was run to generate the *z* values for each item as illustrated in table 4.4.

Table 4.4: Mann- Whitney U and Wilcoxon W for combined South African and South Korean data

No	Contexts preferred	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (2-tailed)
1	The Mathematics involved in learners' favourite sport	3,162.000	4,932.000	-3.347	0.001
2	The Mathematics involved in secret codes such as pin numbers used for withdrawing money for an ATM	2,934.000	4,587.000	-3.599	0.000
3	The Mathematics involved in political matters such as the allocation of seats for parliament given to political parties after an election	3,339.000	5,050.000	-2.771	0.006
4	The Mathematics involved in agriculture such as deciding the number of cattle to graze in a field of a certain size	3,741.500	5,452.500	-1.339	0.181
5	The Mathematics linked to modern clothes and shoes young people like	3,474.000	5,185.000	-2.335	0.020
6	The Mathematics in making bridges, airplanes and rockets	3,739.000	5,450.000	-1.677	0.093
7	Mathematics that will help learners to understand how decisions are made about the sustainable harvesting of natural resources such as the amount of fish that can be caught during a season or the amount of trees that	3,729.500	5,440.500	-1.676	0.094

	can be cut in a forest.				
8	Mathematics that will help learners to do Mathematics at universities and technikons	2,597.000	4,308.000	-4.795	0.000
9	The Mathematics involved in making pension and retirement schemes	2,552.000	4,263.000	-4.862	0.000
10	The use of Mathematics in issues about health such as Mathematics used to prescribe the amount of medicine a sick person must take; Mathematics used to describe the spread of diseases such as HIV/AIDS	2,643.000	4,354.000	-4.727	0.000
11	The Mathematics of a lottery and gambling	3,791.500	5,502.500	-1.438	0.151
12	The Mathematics to assist in the determination of the level of development regarding employment, education and poverty of their community	2,864.000	4,575.000	-4.137	0.000
13	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	3,786.500	5,497.500	-1.510	0.131
14	The Mathematics of inflation	3,469.000	5,180.000	-2.193	0.028
15	The kind of work mathematicians do	2,487.000	4,198.000	-4.972	0.000
16	Mathematics involved in the sending of messages by SMS, cell phones and e-mails	3,554.000	5,265.000	-2.135	0.033
17	Mathematics involved in determining levels of pollution.	3,258.500	4,969.500	-2.920	0.004
18	Mathematics involved in military matters	2,975.500	4,628.500	-3.553	0.000
19	To do their Mathematics with calculators and computers	3,193.500	4,846.500	-2.904	0.004
20	Mathematics linked to rave and disco dance patterns	4,136.500	5,847.500	-0.509	0.611
	a. Grouping Variable: Country				

4.2.1 Mathematical calculation of the *U*-statistic:

The statistic : $U = n_A n_B \frac{1}{2} n_A(n_A + 1) - T_A$, according to McCall (1970: 325) is used when the number of cases in each group is 20 or less. The number of cases in this study is greater than 20. From table 3.1 it is clear that n_A (South African sample) is 149 and n_B (South Korean sample) is 60. According to McCall (1970) , the observed value of U approaches a normal distribution with :

mean = ½ $n_A.n_B$

and

standard deviation = $\dfrac{\sqrt{(n_A)(n_B)(n_A + n_B + 1)}}{12}$

The significance of U_{obs} may then, in the case of the size of a group larger than 20 be determined by:

$$Z_o = \frac{U_{obs} - \frac{1}{2} n_A.n_B}{\dfrac{\sqrt{(n_A)(n_B)(n_A + n_B + 1)}}{12}}$$

4.2.2 Construction of hypothesis

(a) Null Hypothesis - H_0 : There are no differences between the contexts preferred by a group of teachers from South Africa and a group of teachers from South Korea.

(b) Alternative Hypothesis: There are differences between the contexts preferred by a group of Mathematics teachers from South Africa and a group of Mathematics teachers from South Korea.

4.2.3 Rules for decision:

(a) If $-1.96 < z < 1.96$, do not reject H_O.

(b) If $z \leq -1.96$ or $z \geq 1.96$, reject H_O . (McCall, 1970: 331)

When the decision rules are applied to the data the following are evident:

(1) For a minority of items (6), $-1.96 < z < 1.96$ and we cannot reject the H_O. This means that for these items, there are no significant differences between the two populations.

(2) For a majority of items (14), $z \leq -1.96$ or $z \geq 1.96$ and therefore the alternative hypothesis holds which means that there are significant differences between the preferences for contexts to be used in Mathematics by a group of selected teachers from South Africa and their counterparts from South Korea.

4.3 Summary

This chapter dealt with the quantitative analysis of the data by firstly identifying the three highest ranked items and the three lowest ranked items from both cohorts of teachers. A difference and similarity have been detected. The null hypothesis (H_0) that there is no significant differences between the two cohorts was rejected. By using the Mann-Whitney U test, it was shown that there exist a significant difference between the cohorts for particular items. This significant difference lies between the items highly ranked as well as in the items lowly ranked. In the minority of items there was no significant difference between the two cohorts.

The last chapter follows and will focus on conclusions that can be drawn from this study as well as proposed recommendations.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This study investigated the contexts preferred by teachers in South Africa and South Korea. It is assumed that these preferences will lead to an improvement of the teaching and learning of Mathematics. This study pursued the research question about the contexts preferred by the two cohorts of teachers by focusing on the following:

i) What are the contexts that South African and South Korean teachers of Mathematics prefer to deal with in school Mathematics?

ii) Are there significant differences or similarities between the preferences of the two cohorts of teachers?

A summary and discussion of the answers to these questions will be given in this chapter. This chapter will also deal with the limitations and significance of this study and recommendations for further research will be made.

5.2 Summary

This study found that:

1. The sample of South African teachers most highly prefer Mathematics for access to tertiary institutions, contexts related to health and engineering issues whilst for the sample of South Korean teachers the most highly preferred contexts related to technology, community development and environmental sustainability issues.
2. There are significant differences between the two groups regarding most of the contexts that they prefer. For a minority of contexts no significant differences between the two cohorts of teachers were detected.

Based on the findings of this study it is concluded that the two cohorts of teachers differ in their preferences of context that they feel strongly about and that they are similar in their preferences of the contexts that they least prefer.

5.3 Discussion of findings

This discussion of the findings centre around the three most preferred and the three least preferred items of the two cohorts.

5.3.1 The three most preferred items

I constructed table 5.1 from the three most preferred items of both cohorts of teachers to enable me to make a finer comparison between the two cohorts. I used this table to determine which of the items differed significantly between the two cohorts.

Table 5.1: The three most preferred items for the two cohorts of teachers

	South Africa	South Korea
	The use of Mathematics in issues about health such as Mathematics used to prescribe the amount of medicine a sick person must take; Mathematics used to describe the spread of diseases such as HIV/AIDS (T10).	The Mathematics in making bridges, airplanes and rockets (T6)
Significant differences between the ranking of the two cohorts	Yes	No
	Mathematics that will help learners to do Mathematics at universities and technikons	The Mathematics to assist in the determination of the level of development regarding employment, education and poverty of their community
Significant differences between the ranking of the two cohorts	Yes	Yes
	The Mathematics in making bridges, airplanes and rockets (T6)	Mathematics that will help learners to understand how decisions are made about the sustainable harvesting of natural resources such as the amount of fish that can be caught during a season or the amount of trees that can be cut in a forest
Significant differences between the ranking of the two cohorts	Yes	No

From table 5.1 it is clear that the South African cohort of teachers ranked "the use of Mathematics in issues about health such as Mathematics used to prescribe the amount of medicine a sick person has to take and Mathematics used to describe the spread of disease such as HIV/AIDS (T10)" as the most preferred context. This item has also been ranked higher by the South African teachers than by their South Korean counterparts and this difference is significant. A plausible reason for this can be that health issues are the current topics featuring prominently in the media and that great focus is being placed on the prevalence of HIV/AIDS in contemporary South Africa.

The item, "Mathematics that will help learners do Mathematics at Universities and Technikons (T8)" has been identified as the second most important context by the South African cohort and is also ranked higher by the South African teachers in comparison to the South Korean teachers. The South African teachers regard Mathematics to provide access to institutions of higher learning as more important as their South Korean counterparts. This can be attributed to the fact that education is seen as the one tool that will enable the South African youth to escape the vicious cycle of poverty in South Africa. On the other hand it is widely reported South Korean learners invest a lot of time and effort to gain access to institutions of higher learners. This is evidenced by large numbers of learners attending supplementary mathematics classes to improve their chances of gaining high scores in mathematics in order to enhance their chances to gain access to these institutions. To teachers it is thus probably automatic that learners readily assume that they do mathematics that will help them do mathematics at institutions of higher learning.

"Mathematics in making bridges, airplanes and rockets (T6)" has been identified as the third important context by the South African teachers and the Korean cohort of teachers identified the "Mathematics in making bridges, airplanes and rockets (T6)" as amongst the most preferred items for inclusion in the Mathematics curriculum. The choices of the South Korean cohort can be linked to the economic and industrial progress of South Korea. Firstly the mathematics linked to careers in industry is regarded as important in South Korea. One of the teachers from South Korea motivated his choice of most preferred contexts as follows:

> "Technology of science is economic strength, therefore we have to teach the base ability in the common people. I think that the improvement of the maths scholastic ability is made with our heart and soul."

The second most important item according to the South Korean cohort was "Mathematics to assist in the determination of the level of development regarding employment, education and poverty of their community (T12)." The following are motivations from South Korean teachers for their choice of preferences:

> "Helping of neighbours and service are keeped in mind of child."
>
> "They know, mathematics are how to be employed in society."
>
> "The education for one's old age and health is started from the middle school, only so nation attempt to develop, of course individual or community also."

These motivations indicate a strong community ethic underpinning education South Korea. That the South Korean teachers ranked this item higher than the South African ones is surprising. Given the level of overall development of South Korea relative to South Africa one would have expected that South African teachers would rank this higher than South Korean teachers.

The third most preferred item chosen by the South Korean cohort was "Mathematics that will help learners to understand how decisions are made about the sustainable harvesting of natural resources such as the amount of fish that can be caught during a season or the amount of trees that can be cut in a forest." Motivations from South Korean teachers are:

> "We need maths for management of the effective use of resources on earth and our environment."
>
> "They need to study and to training for conservation of nature."

Regarding sustainable harvesting the differences in ranking were not significant. Given that the South African cohort ranked this item in the top half of the preferences it cannot be unequivocally concluded that they accord less importance to sustainable harvesting.

5.3.2 The three least preferred items

Table 5.2 shows the three least preferred items from the two cohorts of teachers.

Table 5.2. The three least preferred items for South African and South Korean teachers.

	South African teachers	South Korean teachers
	Mathematics linked to rave and disco dance patterns (T20).	The Mathematics of a lottery and gambling (T11).
Significant differences between the ranking of the two cohorts	No	No
	The Mathematics of a lottery and gambling (T11).	Mathematics involved in military matters (T18).
Significant differences between the ranking of the two cohorts	No	Yes
	Mathematics involved in	Mathematics linked to rave

	military matters (T18).	and disco dance patterns (T20).
Significant differences between the ranking of the two cohorts	Yes	No

From table 5.2 it can be seen that there are no significant differences between the two cohorts for items T20 and T11 whilst there is a significant difference between them for item T18.

Both cohorts accorded a low endorsement to the item “Mathematics involved in a lottery and gambling.” A plausible reason for this low endorsement is the attachment of the negative consequences of this activity. As a teacher from South Africa motivated the low endorsement :

> “If you want to instill positive value these [lottery and gambling] might be the opposite effect.”

A South Korean teacher motivated as follows:

> “It’s increasing the mind of good luck and decreasing the sincerely endeavor attitude.”

With regard to the Mathematics involved in military matters it is noted that there is a significant difference between the two cohorts. South African teachers agree with their South Korean counterparts that this kind of Mathematics might not be appropriate to grade 8 – 10 learners. A South African teacher, for example, noted that:

> “Learners might be too young to handle the responsibility of this kind of knowledge”

Similar sentiments were expressed by South Korean teachers. One of the South Korean teachers motivated the low preference of this item as:

“These are not needed to grade 9-10, that maths is a level of college maths”

Taking everything into account, it appears that the items that are lowest endorsed are influenced by considered values teachers deem appropriate to be distributed by schooling and the maturity levels of learners. This concurs, in a more general sense, with the assertion that “teachers do not ‘take easily’ to contexts which they perceive as having the potential of ‘strengthening’ the ways and habits which burden societies in low socio-economic status areas.” (Julie, 2005: 69).

5.4 Limitations of the study

This study has some limitations. Firstly, there is the issue of the translation of the instrument. Although all necessary precautions were taken there can never be certainty that the translated carried the same meaning for the two cohorts.

A second limitation is the differences between the teaching environments of the two cohorts. The South African cohort taught in an environment serving learners from LSES backgrounds. The South Korean teachers were more representative of teachers teaching in grades 8 to 10 in that country.

Thirdly, as with any survey instrument, there can never be certainty that the selected items to which teachers responded are of sufficient inclusivity of the myriad of contexts that can be used in mathematics.

Lastly, the instrument allowed a choice from only four response categories. Again as with any survey instrument the appropriate number of response categories remains an open question.

5.5 Recommendations for further study

The specific focus of this study was to determine what the context preferences of teachers from South Africa and South Korea are and if differences and/or similarities exist between the two groups. The data generated through the survey instrument provide the opportunity for further and deeper analysis. Deeper qualitative analysis of the reasons given by teachers for preferring or not preferring certain items lies beyond the scope of this study and can provide further insight into the question of whether contexts preferred by teachers have an influence on the teaching and learning of Mathematics.

5.6 Final comment

This research has contributed towards broadening my view to become knowledgeable about desirable contexts to be used in the teaching of Mathematics. This research has helped me to develop an understanding of the differences or similarities in the context preferences between a selected group of educators from a developed country (South Korea) and that of their counterparts from a late developing country (South Africa).

TIMSS (2003) has shown that South African learners performed poorly whilst the South Korean learners were of the top performance in these benchmarking tests. Taking into account that the teacher has ultimate control over dealing with the topics in school mathematics, it is important to know that the teachers' beliefs should be included in the Mathematics curriculum to be taught in their schools. Given the fact that both countries have a centralized system of educational provisioning, the Mathematics curricula are designed by experts. If a context driven curriculum is implemented, it stands to reason that the designers of the curriculum should be aware of the context preferences that teachers and learners have. This study, it is hoped, will contribute to heightening of this awareness.

References

Barnes, M.S.2006. A comparison between contexts learners in grades 8,9 and 10 prefer for Mathematical Literacy. A thesis submitted in partial fulfillment of the requirements for the M.Ed degree in the faculty of Education, University of the Western Cape.

Bennet, N. 1989. Changing perspectives on Teaching- Learning processes in Era. *Developments in Learning and Assessment*, Murphy, Patricia and Moon, Bob (Ed.). 1989. The Open University, Kent. Hodder and Stoughton Ltd.

Blum, W and Niss, M .1991. Applied Mathematical Problem Solving, Modelling, Applications and Links to other subjects-state, trends and issues in mathematics instruction, educational studies in mathematics.

Busse, A. and Kaiser, G. 2003. Context in Application and Modelling – an Empirical approach. In Ye, Q, Blum, W, Houston, K and Jiang,Q (Eds), *Mathematical modelling in Education and Culture:* ICTMA 10.

Clarke,D and Helme, S .1998. In Björkqvist, O(Ed). Mathematics from a Constructivist Point of View. *Reports from the Faculty of Education, Åbo Akademi University.*No. 3, 1998. HØ GSKOLEN I HEDMARK, Bibliotetjenesten, Avd for laererutdanning, Hammar 2318 HAMAR.

Complete Wordfinder, Readers Digest, OXFORD, 1993.

Dawson, B and Trapp, R.G .1994. Basic & Clinical Biostatistics – a LANGE medical book. Fourth Edition. Lange Medical Books/McGraw-Hill.

De Lange, J, Kietel, C, Huntley, I & Niss, M. 1993. Innovations in Maths Education

By Modelling and Applications. London: Ellis Horwood.

Demana F. et al. 2004. Precalculus: graphical, numerical, algebraic. Sixth edition. Boston , New York Pearson Education , Inc.

.

Department of Education .1996. National Qualifications Framework Learning Area: Mathematics and Mathematical, Information Document (Unpublished), Pretoria.

Department of Education .2000: Review and Modernisation of Further Education and Training – Programmes for Mathematics, Discussion Document, (Unpublished Draft, 1 March 2000) – Pretoria.

Department of Education. 2002. C2005 Revised National Curriculum Statement GradesR - 9 (schools) Mathematics Policy. http://education.pwv.gov.za , 2005/12/18.

Department of Education .2005. Learning Programme Guidelines: Mathematics, Further Education and Training. Policy Document. Pretoria.

Department of Education. 2005. National Curriculum Statement Grades 10-12 (General); Learning Programme Guidelines: Mathematics, 29 April 2005.

Ernest, P. (Undated): *The nature of Mathematics and Teaching: Philosophy of Mathematics Education* (POME), Newsletter 9. http://www.people.ex.ac.uk/PErnest/pome/pompart7.htm 2005/12/18

Field, A. 2005. Discovering statistics using SPSS. 2nd ed. London: SAGE Publication.

Harris M. 1991 (Ed.): *Schools, Mathematics and Work*. Hampshire RG24 OPR. The Falmer Press.

Hoogland, K. 2003. Mathematical Literacy and Numeracy. APS-National Center For School Improvement. Utrecht.

Jablonka, E.2003. Mathematical Literacy. In Bishop, A.J, Clements M.A, Keitel, C, Kilpatric,K and Leung, F.K.S(Eds), *Second International handbook of Mathematics Education.(77-104).*Dordrecht:Kluwer Academic Publications.

Julie, C. (1997). An interpretation of the specific Outcomes of the learning area: Mathematical Literacy, Mathematics and Mathematical Sciences as artifacts of the Mathematical Sciences. Department of Didactics, School of Sciences and Mathematics Education, University of the Western Cape, Bellville.

Julie, C. (2004). Can the Ideal of the Development of Democratic Competence be Realized Within Realistic Mathematics Education? The Case of South Africa' *The Mathematics Educator,* 14(2), 34–37.

Julie, C and Mbekwa, M. (2005). What would grade 8 learners prefer as context for Mathematical Literacy ? The case of Masilakele Secondary School. Perspectives In Education, 23 (3), 31 – 43.

Julie C. (2005). *The context learners prefer for Mathematical literacy and their link to present day issues in South Africa.* Unpublished paper presented at the 12th International Conference on the teaching of Mathematics and its applications, City University, London, 10 -14 July , 2005.

Julie, C. (2005). *Teacher's preferred contexts for Mathematical literacy and Mathematics for action*. Paper submitted for review for SAARMSTE 2006. School of Science and Mathematics Education, University of the Western cape, South Africa. cjulie@uwc.ac.za.

Julie, C. (2006). Mathematical Literacy: Myths, further inclusions and Exclusions. *Pythagoras*, Volume 63, 35 – 42.

Julie , C. 2007. Teachers' context preferences for mathematics in grades 8 to 10 In South Africa. Department of Didactics. School of Science and Mathematics Education, University of the Western Cape, South Africa. cjulie@uwc.ac.za.

Julie, C, Holtman, L, and Mbekwa,M. (2007) : Unpublished: *Rasch modeling of Mathematics and Science teachers' preferences of contexts to be used In Mathematical Literacy.* Paper presented for publication to the Southern African Association for Research in Mathematics, Science and

Technology Education.

Kelly A.V. (1989): The Curriculum. Theory and Practice. Third Edition. London. Paul Chapman Publishing Ltd. 144 Liverpool Road N1 1 LA.

Kim, S.H. 2006. Preferred contexts for Mathematical Literacy of Korean Grade 8-10 Learners. A mini thesis submitted in partial fulfilment of the requirements for the degree of Master of Education in the Faculty of Education, University of the Western Cape

Leung, F.K,Graf, K-D and Lopez-Real, F.J.(Eds). Mathematics Education in East Asia and the West: Does culture matter?. *Mathematics education in different Cultural Traditions – A comparative Study of East Asia and the West: The 13th ICMI Study.* Springer Science & Business Media,Inc.

Lesch, R. (1980). Applications: Which, why, how? In Sharon S and Reys R.E. (Eds). *Applications in school Mathematics.* National Council of Teachers of Mathematics: Reston, Virginia. (pp 8-19).

Meddis R. (1984). Statistics using ranks – a unified approach. Oxford. Basil Blackwell Publishers Ltd.

McCall, R.B. (1970). *Fundamental Statistics for Behavioral Sciences*. Fourth Edition. Harcourt Brace Jovanovich Inc. Orlando, Florida.

National Education and Training Forum .1994 :*Recommendations to the NETF*

Minutes from the Field Committee: Mathematics, October 1994. Department of Education, Pretoria.

National Council of Teachers of Mathematics (1980). Applications in School Mathematics. Sharon S & Reys R.E. (eds.), 1979 Yearbook ,NCTM, USA.

Niss M.(1985). International Journal of Mathematics, Science and Technology, 1987, vol.18, No.4 p487 – 505. Taylor & Francis Ltd. Philadelphia, Pennsylvania.

Pugalee D.K.(1999). The Clearing House, vol. 73, no.1.Bell and Howell information http://www.umi.com , 2005/12/18

Shumway Primary Phase R.J. Ed. Research in Mathematics Education: *ProfessionalSeries* National Council of teachers of Mathematics. (1980) NCOTM, Virginia, USA.

South African Qualifications Authority (SAQA)(1999): National Standards Body Manual, Pretoria.

Stillman G.(1998). Nordic Studies in Mathematics Education No 3 – 4 , 1998. M.Ed lecture notes 2005.

Swetz F.(1991):Incorporating Mathematical Modelling into the Curriculum. http://watt.enc.org/online/ENC2187/2187.html

Trends in International Mathematics and Science Study.(TIMSS)). 2003.
TIMSS & Pirls International Study Center.Lynch School of Education, Boston College

Triola M.F & Franklin L.A (1995). Business Statistics. New York.
Addison-Wesley Publishing Company, La Grange.

Western Cape Education Department (1996) : Syllabus for Mathematics, Junior Primary Phase : Implementation date: January 1996.

Western Cape Education Department (2001) : Assessment: Resource Pack 2 Intermediate – Senior Phase. Directorate : Curriculum Management May 2001

Western Cape Education Department (2005): Human Capital Strategy in the Western Cape: A WCED lead strategy – A focus on Youth 2004 – 2014 , Draft February 2005, Cape Town FET College, Athlone ,24 – 25 March 2005.

Appendices:

Appendix 1: South African Questionnaire- English version

Appendix 2: South Korean Questionnaire – Korean version

APPENDIX 1

Teacher questionnaire: English Version CODE:

RELEVANCE OF SCHOOL MATHEMATICS EDUCATION (ROSME)
TEACHER QUESTIONNAIRE
October 2004

Things I'd like learners in grades 8 to 10 to learn about in Mathematics

Iam: a female….. a male …….

I am........years old I am teaching: ....

(Example: English to grade 9, Physical Science to grade 12; etc.)

I have been teaching for: ....years

What would you like learners in grades 8 to 10 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 agree that learners should be learning about the specific topic. Please respond to all the items.

1 = Strongly disagree
2 = Disagree
3 = Agree
4 = Strongly agree

There are no correct answers.
We want you to tell us how much you agree that learners should be learning about these things in mathematics classes.
The items are in no particular order of importance.
The learners of interest are those in grades 8 to 10.
Thank you for your co-operation

Things I'd like learners in grades 8 to 10 to learn about in Mathematics	disagree	Disagree	Agree	Strongly agree
The mathematics involved in learners' favourite sport	1	2	3	4
The mathematics involved in secret codes such as pin numbers used for withdrawing money for an ATM				
The mathematics involved in political matters such as the allocation of for parliament given to political after an election	1	2	3	4
The mathematics involved in agriculture such as deciding the of cattle to graze in a field of a certain size	1	2	3	4
The mathematics linked to modern clothes and shoes young people like	1	2	3	4
The mathematics in making bridges, airplanes and rockets	1	2	3	4
Mathematics that will help learners to understand how decisions are made about the sustainable harvesting of natural resources such as the fish that can be caught during a or the amount of trees that can be cut a forest.	1	2	3	4
Mathematics that will help learners to do mathematics at universities and technikons	1	2	3	4
The mathematics involved in making pension and retirement schemes	1	2	3	4
The use of mathematics in issues about health such as mathematics prescribe the amount of medicine a person must take; mathematics used describe the spread of diseases such HIV/AIDS	1	2	3	4

Things I'd like learners in grades 8 10 to learn about in Mathematics	Strongly disagree	Disagree	Agree	Strongly agree
The mathematics of a lottery and gambling	1	2	3	4
The mathematics to assist in the determination of the level development regarding employment, education and poverty of their community	1	2	3	4
The placement of emergency such as police stations, fire brigades ambulance stations so that they can reach emergency spots in the possible time	1	2	3	4
The mathematics of inflation	1	2	3	4
The kind of work mathematicians do	1	2	3	4
Mathematics involved in the sending messages by SMS, cellphones and e-mails	1	2	3	4
Mathematics involved in determining levels of pollution.	1	2	3	4
Mathematics involved in military matters.	1	2	3	4
To do their mathematics with calculators and computers	1	2	3	4
Mathematics linked to rave and disco dance patterns	1	2	3	4

Which three items of those that you have marked with 4 above would you definitely want learners to learn about in their mathematics classes. (Mark the three with a cross)

PI	P2	P3	P4	P5	P6	P7	P8	P9	P10
PII	P12	P13	P14	P15	P16	P17	P18	P19	P20

Why would you want learners to learn about these three items?

With which three items above do you the least likely agree that learners should learn about in their mathematics classes. (Mark the three with a cross)

PI P2 P3 P4 P5 P6 P7 P8 P9 I P10 PII P12 P13 P14 I PIS P16 P17 P18 P19 | P20

Why should these items not be included in their mathematics classes?

번호:....................

학교 수학교육의 관련성 교사 설문지
2004 년 10 월

중 2 에서 고 1 수학교육에 대해서 학생들이 배우기를 원하는 것

아래 항목에 기입하여 주시기 바랍니다.

성별: 남_______ 여_______

나이: ______________세

교과과목: 학년 1, 3 과목명__________________________

교사경력: ______________ 년 ______________개월

선생님은 중 2 에서 고 1 의 학생들이 어떠한 것과 관련되어서 수학을 배우는 것을 원하십니까? 다음 표에는 몇 가지 가능한 예들이 기록되어있습니다. 다음 각 항목마다, 학생들이 주어진 주제를 학습하는 것에 대해 어떻게 생각하시는지 네모 안에 있는 하나의 숫자에만 표시 (O 표) 를 해 주십시오. 각 항목에 반드시 답을 해 주시기를 바랍니다.

1 = 절대 그렇지 않다
2 = 그렇지 않다
3 = 그렇다
4 = 아주 그렇다

이 문항에 대한 정답은 없습니다. 우리는 학생이 수학 교과의 아래 내용을 학습하는 것에 관한 당신의 의견을 원합니다. 아래 문항은 중요도 순이 아닙니다. 대상 학생들은 중 2 에서 고 1 입니다.
협조에 감사 드립니다

1

공란	중2에서 고1 학년학생이 수학에서 배웠으면 하는 것들	절대 그렇지 않다	그렇지 않다	그렇다	아주 그렇다
T1	학생들이 좋아하는 운동과 관련이 있는 수학	1	2	3	4
T2	현금자동인출기의 비밀번호와 같은 것에 관련이 있는 수학	1	2	3	4
T3	선거 후 각 정당 별 국회의 의석 배정 수와 관련이 있는 수학	1	2	3	4
T4	목장의 면적과 이 면적으로 사육 가능한 소의 수와 관련한 수학	1	2	3	4
T5	청소년들의 옷과 신발에 관련 있는 수학	1	2	3	4
T6	다리를 건설하고 비행기와 로켓을 만드는데 관련된 수학	1	2	3	4
T7	물고기나 나무 같은 천연 자원의 보존 가능한 범위 내에서 수확량을 결정하는 수학	1	2	3	4
T8	학생들이 대학과 전문대학에서 수학을 배우는 것을 도움을 주는 수학	1	2	3	4
T9	연금과 퇴직 이후의 계획에 관련된 수학	1	2	3	4
T10	에이즈와 같은 병의 확산율과 환자의 약의 양을 처방하는 것과 같은 분야처럼 건강과 관련된 문제에 쓰이는 수학	1	2	3	4
T11	복권과 도박에 관련이 있는 수학	1	2	3	4

공란	중 2 에서 고 1 학년학생이 수학에서 배웠으면 하는 것들	절대 그렇지 않다	그렇지 않다	그렇다	아주 그렇다
T12	지역사회의 고용, 교육과 빈곤에 관한 개발 정도를 측정하는데 도움이 되는 수학	1	2	3	4
T13	경찰서, 소방대와 구급차 사물실 등의 긴급 서비스 기관이 긴급 상황 지역에 최대한 빨리 도착할 수 있게 위치 설정에 도움을 주는 수학	1	2	3	4
T14	경제 인플레이션과 관련된 수학	1	2	3	4
T15	수학자들이 하는 일의 종류	1	2	3	4
T16	문자메세지, 휴대폰, 이메일 등으로 메시지를 보내는 것에 관련된 수학	1	2	3	4
T17	공해 정도를 측정하는데 관련된 수학	1	2	3	4
T18	군사 문제에 관련된 수학	1	2	3	4
T19	계산기와 컴퓨터로 수학을 하는 것	1	2	3	4
T20	콘서트와 디스코 댄스에 관련된 수학	1	2	3	4

1) 위의 항목 가운데 4 (아주 그렇다) 라고 표시한 항목중에 학생들이 수학교과에서 가장 배웠으면 하는 3 가지를 고르세요. (X 표를 3 개 하세요).

T 1	T 2	T 3	T 4	T 5	T 6	T 7	T 8	T 9	T 10
T 11	T 12	T 13	T 14	T 15	T 16	T 17	T 18	T 19	T 20

2) 위 1) 에서 선택한 이 세 가지를 왜 학생들이 배워야 한다고 생각하십니까? 설명하십시오

....

....

....

....

....

3) 위의 표에서 학생들이 수학 시간에 배워야 할 것 중에서 "절대 그렇지 않다"의 항목중 가장 그렇게 생각하는 3 개를 표시하십시오 (3 가지를 X 표시 해주십시오.).

T 1	T 2	T 3	T 4	T 5	T 6	T 7	T 8	T 9	T 10
T 11	T 12	T 13	T 14	T 15	T 16	T 17	T 18	T 19	T 20

4) 위 3) 에서 말한 이것들이 수업시간에 왜 적당하지 않다고 생각하십니까?

....

....

....

....

....

5) 위의 표에 적은 것을 제외하고 학생들이 어떤 생활 수학을 배우는 것이 좋을지 3 가지를 써주십시오.

....

....

....

....

....

6) 학생들이 생활 수학을 배우는 것이 왜 중요하다고 생각하십니까?

....

....

....

....