

PREFERRED CONTEXTS OF KOREAN YOUTH

FOR THE LEARNING OF SCHOOL

MATHEMATICS (GRADES 8-10)

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ABSTRACT

This study investigated real life situations which learners in South Korea grade 8-10 learners would prefer to be used in school mathematics.

This thesis is based on the ROSMEII (Relevance of School Mathematics Education) questionnaires and interviews, which was used to examine the preferred mathematical learning contexts for South Korean grade 8-10 learners. The study investigates the affective factors that pupils perceive to be of possible relevance for the learning and teaching of mathematics; and is aimed at providing data that might form part of a basis for a local theory of the mathematics curriculum. The standardized ROSMEII survey questionnaire of 23 close-ended items that relate to some aspects of mathematics on a 4-point Likert-type scale was administered to Korean grade 8-10 learners at the end of compulsory schooling, and mainly 14 to 16 year old cohorts. The data for this study were collected from a sample of 1839 learners drawn from 26 South Korean schools in the year 2009.

Interviews were conducted to gauge the pupils' preference of the ROSMEII questionnaire contexts and used to validate learners' responses. In analyzing their responses, it became clear that, on the average, views expressed were common to all groups of pupils in South Korea (whether male or female, or from the metropolitan, city, or countryside). The clusters of the most preferred mathematical learning contexts are linked to youth culture, which learners are usually and easily engaged with in one way or another. These clusters include the sports, leisure and recreation cluster; planning a journey/popular youth culture cluster the technology cluster; the making of computer games, storing music and videos on CD's and I-pods. The lowest preferred mathematical learning contexts are: an agricultural cluster which focuses on agricultural *matters* and traditional games (*yut*).

In conclusion, this study suggests that teachers should use contexts that increase learners' interest in classroom activities. Therefore mathematics curricula and textbooks which are appropriate to this context must be provided in order to provide more efficient mathematics education. It is imperative that the Korean school system must develop a particular program for nurturing learners' mathematical power. Furthermore, mathematics education policy makers must reconsider whether the current education system is appropriate, and also listen to learners' preferences when designing appropriate mathematics curriculum and textbooks.

Declaration

I declare that PREFERRED CONTEXTS OF KOREAN YOUTH FOR THE LEARNING OF SCHOOL MATHEMATICS (GRADES 8-10)) is my own work, that it has not been submitted before for any degree or examination in any other university, and that all the sources I have used or quoted have been indicated and acknowledged as complete references.

Sun Hi Kim

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Signed



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The twenty-first century requires mathematical power, thus making the revision of mathematical curriculum for using real life situations. As a missionary working in South Africa I wish to make a tiny contribution to this field, and this desire led me to conduct this study.

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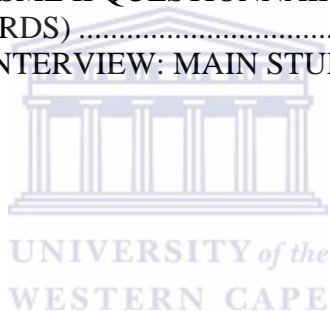


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CHAPTER 1

1.0 Introduction

In the investigation of learner's preference for contexts for mathematics learning at schools and their real-life situations, Korean students of grades 8 to 10 are well suited for this study. This research investigated learners' preferred contexts for the learning of school mathematics and the real life situations Korean grade 8-10 learners would prefer to be used in school mathematics. Korea has received attention from mathematics educators all over the world because of: 1) its prosperity in mathematics and technological innovations as well as economic development over several decades without losing its cultural identity; and (2) students' high academic performance in international tests of mathematics such as Trends in International Mathematics and Science Study (TIMSS), the Organisation for Economic Co-operation and Development (OECD), Program for International Student Assessment (PISA) and the International Mathematics Olympiad (IMO). The above is possible despite Koreans having the lowest attitudes towards, and interests in, mathematics. In Korea, education professionals as well as the general public (Yeom, 2008; Yoo, S-Y 2009; Hankyure Newspaper 2012) have serious concerns about teenagers' disinterest in learning activities in general and mathematics in particular within real life situations. The TIMSS-R results triggered public debates in Korea.

1.1 Background to present study

Mathematics educators seek to identify the factors that cause teenagers to dislike mathematics learning in schools. In order to get such information, international surveys, such as IEA/TIMSS and OECD/PISA, are relevant so as to also understand students' preference towards and ability to adapt real life situations in mathematics. 'The Relevance of School Mathematics Education' survey (ROSME), an international comparative research project further examines this phenomenon. Volunteer researcher groups from South Korea, South Africa, Norway, Albania, Swaziland and Zimbabwe have been involved in the project.

The primary aim of this report is; 1) to develop an analytical framework, which can readily categorize Korean students into several groups in terms of their preference of mathematics,

from the ROSME data, and (2) to show its applicability and usability for considering appropriate mathematics teaching strategies for respective groups by using the items from the ROSME instrument.

1.2 Korean Participation in International Competitions

Korean learners have participated in international competitions of mathematical achievement such as the Trends in International Mathematics and Science Study (TIMSS) and its follow-up study (TIMSS-R), the Organisation for Economic Co-operation and Development (OECD) Program for International Student Assessment (PISA) and the International Mathematics Olympiad (IMO). The purpose of this participation was to evaluate their mathematical performance in comparison to those learners from other countries such as Singapore, Japan and Hong Kong, in order to objectively review the Korean educational environment as a whole. In these tests, Korean learners ranked highly as shown in the tables below:

Table 1.1: The Results of the Highest Ranked Countries for Mathematics Performance in TIMSS 1995 (Beaton, *et al.* 1996) and TIMSS-R 1999 (Mullis, *et al.*, 2000, Park, 2004a)

TIMSS 1995			TIMSS-R 1999		
Rank	Country	Score	Rank	Country	Score
1	Singapore	643	1	Singapore	604
2	Korea	607	2	Korea	587
3	Japan	605	3	Chinese Taipei	585
4	Hong Kong SAR	588	4	Hong Kong SAR	562

Table 1.2: The Results of the Highest Ranked Countries for Mathematics Performance in TIMSS 2003 (Mullis, *et al.*, 2004; Park, 2004b)

Rank	Country	Score	Advanced International Benchmark	High International Benchmark	Intermediate International Benchmark	Low International Benchmark
1	Singapore	605	44	77	93	99
2	Korea	589	35	70	90	98
3	Hong Kong SAR	586	31	73	93	98
4	Chinese Taipei	585	38	66	85	96
International Average		467	7	23	49	74

Table 1.3: The Results of the Highest Ranked Countries for Mathematics Performance in PISA 2000 (OECD, 2001) and PISA 2003 (OECD, 2004)

PISA 2000			PISA 2003		
Rank	Country	Score	Rank	Country	Score
1	Japan	557	1	Netherlands	551
2	Korea	547	2	Korea	548
3	New Zealand	537	3	Finland	543
4	Finland	536	4	Hong Kong SAR	540
Average		488	Average		499

Table 1.4: The Results of Korean Learners' Performance in IMO (Park, 2004)

Year	Rank	Score	Number of participating countries
1999	7	164	81
2000	4	172	81
2001	4	185	83
2002	6	163	84
2003	6	157	82

Mean country performance in mathematics

To summarize student's performance and to compare the relative standing of countries in mathematics, countries' mean scores on the PISA assessment are used. Countries with high average performance will have a considerable economic and social advantage. As explained before, since mathematics is the focus of the PISA 2003 survey, the PISA 2003 mean score for OECD countries was set at 500. The average score in mathematics in PISA 2009 (496 score points) appears to be slightly lower than the score of 500 in PISA 2003, but this difference is not statistically significant.

When interpreting mean performance, only those differences between countries that are statistically significant should be taken into account. Table 1.5 shows each country's mean score and also for which pairs of countries the differences between the means shown are statistically significant. For each country shown on the left in the middle column, the list of countries in the right hand column shows countries whose mean scores are not statistically significantly different. For all other cases, one country has a higher performance than another if it is above it in the list in the middle column, and lower performance if it is below it. For example: Shanghai-China ranks first, Singapore second and Hong Kong-China third, but the performance of Korea, which appears fourth on the list, cannot be distinguished with confidence from that of Chinese Taipei. Korea, with a country mean of 546 score points in mathematics is the highest performing OECD country. Three partner countries and

economies, Shanghai-China, Singapore and Hong Kong-China, have a mean score that is around one proficiency level or more above the average of 496 score points in PISA 2009.

Table 1.5 A profile of student performance in mathematics and science

Country	Score
Shanghai-China	600
Singapore	562
Hong Kong-China Korea	555
Korea, Hong Kong-China, Chinese Taipei, Finland, Liechtenstein	546
Chinese Taipei, Korea, Finland, Liechtenstein, Switzerland	543

OECD, 2010

1.2.4. Factors for High Achievement in Mathematics

There are various reasons why Korean learners participating in international comparative studies of mathematics achieve so well. The explanations for this is in accordance with five identified influential factors:

1). The focus of education in Korea is on subjects required in Jin-Hak¹ examinations (Park, 2004) of which the very competitive national college entrance examination known as the College Scholastic Ability Test (CSAT) or Su-Neung test² is of most importance. As mathematics is one of the most important subjects in Jin-Hak examinations, this is maybe the major factor influencing learners' high achievements in mathematics. Since learners are affected more by their mathematics results than by any other subject, schools tend to place a

¹This is a Korean word referring to the concept of going up for studying. For example, Jin-Hak refers to go from middle school to high school and from high school to university.

² It is equivalent to Matric in South Africa. However the Su-Neung test must be written every year by every learner who wants to go to university, whilst Matric is not necessarily taken every year by those who want to go to university. The numbers of those who had this exam are 655,384 in 2003, 642,583 in 2004, and 554,345 in 2005.

high importance on mathematics. Thus, for mathematics, Korean learners have private extracurricular lessons called “Goawe.” According to Park (2004), in general 72.6% of the learners have private lessons and of these, 83.1% are elementary learners, 75.3% are in middle school and 56.4% are high school learners.

2). Korean learners have very serious attitudes regarding tests (Park, 2004). Korean learners are brought up to take tests very seriously and as a result generally tend to voluntarily review the subject to be tested before undertaking the test. This kind of attitude might have contributed positively to their performance in the TIMSS and PISA tests.

3). Korean education is characterized by the repetition method. For mathematics education, thus the repetitive learning method is also used. This is similar to the so-called procedure-oriented teaching and learning rather than a conceptually profound one. Within the classroom, this is manifested in the so-called Topaze Effect (Brousseau, 1997), where teachers may feel a kind of social contract in their role and thus consider it a duty to efficiently deliver the content in a given time period.

“Procedural teaching” does not necessarily imply rote learning or learning without understanding. Since understanding itself is a continuous process, this process of learning often starts with gaining competence in the procedure, before learners gradually gain understanding through repeated practice (Leung, 2001). In Korean education, repeated practice is actually the use of a set of exercises that vary systematically and repeated practice is seen as an important method in enabling learners to understand (Hess and Azuma, 1991).

4). The mathematics teacher is required to be very highly competent. Recent studies have shown that teachers in East Asian countries including Korea have a more profound knowledge of fundamental mathematics than teachers in the United States (Ma, 1999; Leung and Park, 2002; Park, 2004). This may be another factor contributing to high achievement.

In Korea, learners who want to become mathematics teachers have one of two options. They either proceed straight into studying mathematics education at a university if they are from the high-achieving group in the CSAT, or they transfer to the department of mathematics after completing a bachelor’s degree in another discipline. Therefore entry into these courses and subsequently into the teaching profession itself is a highly competitive process.

Furthermore, completing a four-year university education does not in itself qualify the graduates to teach in public schools³. The graduation only guarantees them a teacher's certificate, which enables them to teach at private schools. In order to teach in public schools the certificate holders are required to pass a national examination called the Teachers Employment Test (TET).

5. There is a very high competency cycle among mathematics teachers and this passes on to the next generation (Park, 2004). In Korea, there is a high level of competition among schools. Therefore a teacher is held in high esteem as an expert or a learned figure in their subject matter. Those teachers who are not experts in the subjects they teach are not respected. This image of the scholar-teacher may provide incentives for Korean teachers to strive to attain even higher competence levels in both the subject matter and teaching skills. Needless to say, this attitude is passed on to the next generation of teachers.

1.2.5 Performance, application and affective domain of mathematics

1.2.5.1. Performance according to Benchmark Tests

The achievements in the international benchmarks of the TIMSS 2003 have been divided into four categories (Mullis, *et al.*, 2004: 55-88): advanced (625), high (550), intermediate (475) and low benchmark (400)⁴. From table 1-2 above, Korean learners' achievements were distributed among all four benchmarks with 35% qualifying for the advanced international benchmark. Taking the total number of Korean learners who participated, 70% are ranked in the high international benchmark, 90% of Korean learners fall into the intermediate international benchmark and 98% of Korean learners are ranked in the low international benchmark.

³Korea has two types of schools: private and national public schools.

⁴ The number in bracket refers to the total score for the benchmark.

According to this table, almost all the Korean learners were placed in at least the low international benchmark, and this should be enough evidence to show their capacity to work with mathematics. According to the same table the top five highest achieving countries are Singapore, Chinese Taipei, Korea, Hong Kong SAR and Japan. Singapore has the highest results with 44% of its learners in the advanced international benchmark, followed by Chinese Taipei with 38%. Looking at the overall achievement average, Korea is in second place. However under the present classification that only considers results in the advanced international benchmark, Korea ranks third at 35%. It is noteworthy that the top five countries achieved results far higher than the rest of the participating countries.

Of all the participating learners, 7% fall into the advanced international benchmark category, in comparison with the top 5 countries' percentages which range from 31-44% (Korea: 35%). 23% on average fall into the high international benchmark category, and in comparison with the top 5 countries' percentages which range from 66-77%, Korea scored 70%. 49% of all the participating learners are ranked in the intermediate benchmark category, in comparison with the top 5 countries' percentages ranging from 85-93%, Korea scored 90%. In the low international benchmark category comprising of 74% of all the participating learners, in comparison with the top 5 countries' percentages ranging from 96-99%, Korea obtained 98%. The percentage of Singaporean learners' rankings in the various international benchmark categories: advanced, high, intermediate, low, are as such: 44%, 77%, 93% and 99%. Compared to the Korean's percentages (35%, 70%, 90% and 98%), it is noteworthy that there is a 16-mark gap in the mean between Singapore and Korea in the advanced international benchmark.

Korea's overall average is high and the country has an excellent international record, although there is room for improvement at the advanced level. This upward push might be facilitated by the 'PyungjunhwaKyoyuk system'⁵, which was initiated 30 years ago by the

⁵ This is an education system that was employed by the Department of Education in the beginning of the 1970s. Before the inception of this system, learners had to write entrance exams to enter so-called better or best middle and high schools. Since these schools offered study based on the capability of learners, the quality of these schools naturally differed from others. This had a positive and negative impact in Korean society. Nonetheless, the Education Department abolished this system of entrance exams, and instead, created

Korean education department. The results of the TIMSS allowed for the identification of some aspects of our education policy that must be reconsidered especially if the system is to produce more excellent learners that are competitive enough for the international society. In addition to this, the teaching-learning relationship needs to be reconsidered on the basis of its appropriateness to individual learners' contexts, and must also be adjusted to take into account various parameters influencing individual achievement.

It is remarkable to note that the while overall percentage of learners who qualify for the advanced international benchmark has declined, the Korean percentage is increasing; the advanced international benchmark in 1995, 1999 and 2003 was 11%, 10% and 8% respectively' while those for Korea were 31%, 32% and 35% respectively (Mullis, *et al.*, 2004: 66-67).

This phenomenon is also applicable to learners of the other top five countries except Japan, whose numbers have decreased. It appears that the big gap between the top five and the rest of the other countries who participated had already been detected in TIMSS 1995. Considering this, it becomes apparent that the gap in achievement between the top five and the rest of the countries is becoming wider. According to the TIMSS 2003 report (Mullis, *et al.*, 2004: 66-67), the average of the learners' achievements is decreasing (see Table 1.6).

Table 1.6: The Results of the international Benchmark for Mathematics Performance in TIMSS (Mullis, et al., 2004)

Year	Advanced International Benchmark	High International Benchmark	Intermediate International Benchmark	Low International Benchmark
1995	11	37	69	89
1999	10	31	57	80
2003	8	28	56	80

the PyungjunhwaKyoyuk system which allocates learners to schools regardless of academic ability by random selection.

1.2.5 .2 Application of Mathematics

The application of mathematics to real-life contexts in the intended mathematics curriculum can be classified into four categories namely; “a lot of emphasis,” “some emphasis,” “very little emphasis,” and “no emphasis.” Under this classification system, Korea was placed in the “some emphasis” category (Mullis, *et al.*, 2004: 178).

The results of TIMSS 2003 show that Korean learners’ average for the application of mathematical knowledge in solving problematic situations of everyday life is still very low (17%) in comparison with the international average of 44% (Mullis, *et al.*, 2004:281). This implies that Korean mathematics education puts more emphasis on computation and algorithmic skills, and that the lack of understanding of real-world situations has led Korean learners to have difficulties adapting their mathematical knowledge to real-life situations.

1.2.5.3. Affective Dimensions

1.2.5.3.1. Learners’ Self-Confidence in Learning Mathematics

The first point in the affective dimension of mathematics education is learners’ self-confidence in learning mathematics (SCM) (Mullis, *et al.*, 2004:154). Internationally, 40% of the eighth-grade learners on average had a high self-confidence in learning mathematics. In totality in the high self confidence scale, the percentage range between high and low was 59% for Israel and 17% for Japan. Korea performed comparatively lower than other countries and has a 30% in high SCM, a 36% in medium SCM and a 34% in low SCM (Mullis, *et al.*, 2004: 154; Park, 2004b).

It is worthy of note that the four countries, Chinese Taipei, Hong Kong SAR, Japan and Korea with low percentages of learners in the high self-confidence category, had high average mathematics achievements. It is also interesting to note that all of these are Asian Pacific countries that possibly may share cultural traditions that encourage modest self-confidence. This means that learners who have a high SCM do not necessarily have high achievements. However, in Korea those learners who had a high SCM also had high

achievements, thus a motivation for the education system to cultivate methods of teaching and learning which can produce higher SCMs.

1.2.5.3.2. Learners' Valuing of Mathematics

The second point in the affective dimension of mathematics education is learners' valuing of mathematics (SVM) (Mullis, *et al.*, 2004: 158). The index of SVM has three categories namely; high, medium and low. On average, learners generally placed a high value on mathematics, with a high of 55%, 35% in the medium range and a mere 10% in the low category. Learners who exhibited a high level value on mathematics (80% or more) were from Morocco, Botswana, Ghana, Egypt and Jordan. Learners placing less value on mathematics are from Korea, Japan and the Netherlands, which collectively had less than 20% in this category.

The index for Korean learners is as follows: 18% for high (international average is 55%), 59% for medium (international average is 35%) and 23% for low (international average is 10%). Korean learners have an average to high mathematics achievements, but show little enthusiasm for the subject. This phenomenon may be explained by the fact that the learners follow a demanding mathematics curriculum. Their valuing of mathematics is also very low in comparison with other developed countries (Mullis, *et al.*, 2004: 158; Park, 2004b).

1.2.5.3.3. Learners' Enjoyment in Mathematics

The TIMSS 2003 investigated the index of enjoyment in mathematics (Mullis, *et al.*, 2004: 159). This index was divided into three categories namely 'Agree a lot', 'Agree a little' and 'Disagree' and the international averages in each of these were 29%, 36% and 35% respectively. Korean learners scored 9% in the "Agree a lot" category, 34% for "Agree a little," and 57% for "Disagree." This means that 43% of Korean learners like mathematics and 57% do not. By comparison with the international average, Korea shows low averages. According to PISA 2003, the interest of Korean learners in mathematics is ranked 31st out of the 41 countries considered in this survey. According to Park (2004b), this ranking which Korea obtained is very low.

1.2.6. Evaluation of the situation in Korea based on results of comparative studies

Through these international comparative studies, Korean educators have discerned that their learners have many serious weak points, despite their admirable achievements. These areas of weakness are considered in the five points stated below.

Firstly, Korean learners' affective dimension in the confidence and interest categories was amongst the lowest, ranked together with Japan and Lithuania. Secondly, it was noted that the high achievement of TIMSS is mainly not because of a good public education system but a private extracurricular program called "Goawe" (Lew, 2004).

Thirdly, the whole class activities with teachers' control are considered to reform classes and that lessons inevitably rely more on the teachers' verbal explanations and at the same time ignore learners' activities.

Fourthly, it was revealed that Korean mathematics teachers were the lowest ranked amongst countries participating in TIMSS in employing such technologies as computers and calculators. This phenomenon was unexpected because at the time of the TIMSS test, Korea was one of the top five computer manufacturing countries, and every elementary and secondary school had over 50 computers. Most mathematics teachers today, however, agree that technology is an inevitable tool that every learner has to use in this information society (Lew, 2004). The fifth point appeared that many mathematics teachers do not seriously consider mathematical applications in their daily life and thus the reasoning ability to support logical conclusions is not one of the competencies they cultivate. In this regard, Korea belonged to low-rating countries.

With this in mind, it becomes logical to state here that traditionally Korean mathematics teachers focused only on concepts and skills in solving theoretical problems. School education however presupposes the application of mathematics in a variety of situations. There are a lot of cases where one uses mathematics in real life situations.

If skills and knowledge of mathematics are not applicable to everyday life, then mathematics education in schools is obviously not enough. In everyday life, what is more important is the ability to apply mathematical knowledge and skills. Educators realized that learners have an

ability to create an environment conducive to the integration of known knowledge, rather than many individual pieces of knowledge.

Secondly, the content of school mathematics was perceived as being unattractive to learners. The content of mathematics textbooks tend to be more abstract as new symbols, letters, generalizations and proofs are introduced. The contents of mathematics become more complex with an increase in grade level. More learners lose interest in the subject and it is perceived to get worst in high school. These are probable reasons as to why many learners complain that mathematics is too difficult to understand.

A negative attitude towards mathematics can be changed through incorporating investigative activities, and other interesting and challenging problems, rather than sticking to the conventional direct and easy application of knowledge and skills. This approach has the added benefit of improving learners' critical thinking abilities (Jung, 2004).

In conclusion, Korean learners have achieved high marks in international mathematics tests including TIMSS, PISA and IMO, although they scored very low marks in the affective dimension. Furthermore, Korean learners show a weakness in applying mathematics to daily life situations at a time when the world demands mathematical capabilities.

1.3 Introduction to ROSME (The Relevance of School Mathematics Education)

The 'Relevance of School Mathematics Education' project, or in brief, the ROSME project is an international comparative project inspired by the "Science and Scientists" (Sjoberg, 2000) project and its extension, the "Relevance of Science Education" project of Professor Sjoberg (Sjoberg and Schreiner, 2010; Julie and Mbekwa, 2005:32).

1.3.1 ROSME I

Since the 1990's, the educational policy has changed dramatically across the globe. Instead of memorization, emphasis has been placed on creating a paradigm in the system. There is a great need to solve the problem of what contexts learners would prefer when dealing with mathematical education. According to ROSME 1 project, held in 2005/2006, in order to raise

the interest of pupils learning mathematics, it was necessary to know what attracted pupils to learning mathematics. A number of factors were identified.

Firstly, the quality of mathematics education is often graded in terms of the types of mathematics that are worthwhile and valuable for both the student and society. It is also about how to best support students so that they can improve their knowledge of mathematics.

In addition to the factors mentioned above, McLeod (1989b) identified three concepts used in research that affect mathematics education: beliefs, attitudes and emotions. McLeod (1992) differentiated the four axes relating to beliefs: mathematics (the object), oneself, mathematics teaching, and the context in which mathematics education takes place (social context). Goldin (1997) added a fourth element he called values.

Julie (2007) argues that students are sometimes interested in learning mathematics, but that the interest should not only come from students. However, incorporating students' interest in the curriculum is not enough. A school mathematics curriculum where the contextual interests of students, teachers, parents and designers of curriculum and learning resources are balanced needs to be given a chance. Mathematics in Context (MIC) was developed in the United States of America (Villarrubia, 2001: 8) and an example of a starting point for learning mathematics because it is highly contextual and uses real-life situations.

Several studies have been conducted using the ROSME questionnaire. Among these are: (Julie & Mbekwa, 2005; Barnes, 2006; Snyders; 2006; Cornelissen, 2008; Blaauw, 2009; Lebata, 2006; Van Schalkwyk, 2007; Ngcobo, 2011 and Kim, 2006). Other ROSME studies such as (Julie, 2006 and van Schalkwyk, 2007) investigated teachers' positions in the context of learning school mathematics.

The questionnaire was developed from 2003 to 2005. According to Julie and Mbekwa (2005), in designing this questionnaire, topics or clusters were first identified by mathematics educators from Zimbabwe, Uganda, Eritrea, Norway and South Africa. Thirteen (13) clusters including two intra-mathematical ones evolved through the identification process. The identification of the eleventh extra-mathematical cluster was affected mainly 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.

Numerous meetings were held in South Africa to adapt, change or add items in order to have a quality instrument at hand. A pilot study to assess the learners' questionnaire was conducted by Julie and Mbekwa (2005). The final instrument was compiled in January 2005 and contained sixty five (65) items including sixty one (61) closed and four (4) open-ended questions.

Learners responded to sixty one items by selecting a response from one of four response-categories. The response categories on the four-point Likert-type scale were: "not at all interested," "a little bit interested," "interested," and "very interested" for the first sixty one items. The last four items required an open response. Qualitative data (the learners' reasons and drawings) were also collected, but this study by Julie et al. (2005) does not deal with that data.

Julie and Holtman (2008) using the Rasch analysis procedures concluded that there were redundancies in some item subsets where their replacements by an appropriate single item would not affect the validity and reliability of the instrument. Through a series of discussions between mathematics educators and post-graduate students from Zimbabwe, Swaziland, South Korea, South Africa and Albania the questionnaire with 61 items was reduced to 23 items (ROSME II). Learners responded to sixty one items by selecting a response from one of four response-categories. The response categories on the four-point Likert-type scale were: "very high", "high", "low", and "nil/zero". The 23 item questionnaire birthed ROSME II.

1.3.2 ROSME II

ROSME was followed up by the Relevance Of School Mathematics Education II (ROSME II) with the objective of ascertaining whether there were any substantive changes of learners' preferences for contexts to be used in school mathematics between the ROSME (data collected in 2004) and ROSME II cohort of learners. Due to mainly financial constraints, South Korea and South Africa are the remaining participants left in the project and have been joined by Albania. The study reported here is thus situated within the broader ROSME II

project. The ROSME II project focuses on students in the 8th to 10th grades. These are the last two years of compulsory schooling and the start of the final school phase in most countries. I was interested in the ROSME project because it allowed the researchers to find a preferred context in mathematics education for certain targeted learners. In 2009, I administered the adapted questionnaire as part of a ROSME 2 project. In addition I went deeper by interviewing Korean Youth with regard to their preferred contexts for mathematics. The data collection instrument was a questionnaire (Appendix 2). It was based on the questionnaire used in the first ROSME project whose analysis indicated that a reduction of the number of items would not affect the validity of the questionnaire (Julie & Holtman, 2008). Respondents were requested to express their interest on 23 items representing different contexts to be used in mathematics lessons on a 4-point Likert scale ranging from ‘very high interest’ to ‘nil/zero interest’. A further motivational factor for the use of this survey instrument was the need to include a relatively large number of items. The large number was to ensure that as many contexts as possible were covered to address the issue of validity.

The original ROSME questionnaire was developed in English in South Africa (see Appendix 1). The Korean version of the questionnaire was based on the South African version (see Appendix 2). Translating the English version into Korean in February 2009 was undertaken by the researcher. Corrections of the first version were done by a mathematics teacher. The second Korean version has been modified by another mathematics teacher and finally cross-checked with the English version in April 2009.

Notable things in the translations were that two items in the English version were translated according to the Korean context (C with numbers such as C14 and C22 refers to the numbers in the questionnaires). C13, ‘mathematics linked to South African pop music’ was changed to ‘mathematics linked to pop music.’ C2 ‘mathematics linked to decoration such as the house made by Ndebele women’ has been translated into ‘mathematics linked to Korean traditional games such as “yut.”

All the items of this instrument dealt with extra-mathematical situations amenable to mathematical treatment and the responses learners provided to the 23 items were used in the

study reported here. One of the researchers who collected the data was physically present in the class when the students completed the questionnaire in case the respondents had any queries. In a few cases, students did enquire about the connections that Mathematics has with items such as music, dance and health matters. The researcher gave them an indication of mathematics relevance to these contexts without trying to express her preference for it as a desirable context.

1.3.3 Motivation for Korean focus of this study

The present study comes from two motivations, first of which are the learning contexts of mathematics. The twenty-first century demands a high level of mathematical literacy, mathematics in context to be specific. In addition to this, the international mathematics tests such as TIMSS, PISA and IMO have shown that although Korean learners achieved remarkably high marks in comparison to those of other countries, their ability to apply mathematics to real life situations is very low.

Superficially, it appears as if Korean learners possess advanced mathematical knowledge and skills when compared to other learners of the same age group in other countries under review. Most Korean learners however, display an inability to relate their well-developed manipulative skills to realistic contexts found in real-world situations.

Recently the term “saeng-hwal mathematics”⁶ which indicates Realistic Mathematics Education (RME), referring to mathematics education in daily context, has appeared on Korean Internet sites⁷. This type of mathematics education helps learners enhance their capacity to learn mathematics. There have been very few studies done in this area and thus no real challenge has occurred in mathematics education. In this regard, I will describe the learning contexts of mathematics from the learner’s perspective.

⁶Saeng-hwal is a transliteration of Korean into English, referring to life, life situation or daily life.

⁷ For instance, it has appeared at <http://classroom.kice.re.kr/content07/second04/data03/sub8/>.
retrieved on 2006-03-21.

Another motivation, in relation to learners' perspective deals with learners' interest in contextual issues to be used in mathematics. Learners' interest in learning mathematics varies and depends on the teacher's ethos. In this present study I am investigating the degree of learners' interest in contextual situations.

As evidenced in international competitions, the affective dimension in mathematics education that includes interest, self-confidence, the valuing mathematics and pleasure is very low. Positive attitudes to mathematics, however, are related to achievements.

Interest is a person-object relationship that is characterized by value, commitment and positive emotional valences and thus the role of interest is particularly relevant in mathematics because it is perceived as a very difficult subject in which motivational factors are very important for enhancing academic achievement (Köller, *et al.*, 2001).

There have been reports on the importance of academic interest and its relationship to academic achievement and other desirable academic outcomes. Individual interest is hypothesized to be a relatively enduring predisposition to attend to certain objects and activities, and is associated with positive effect, persistence and learning (Hidi and Ainley, 2002; Krapp, 2000; Renninger, 2000).

According to Schiefele (1992:151-182), the overall correlation between interest and academic achievement was about 0.30. This score indicates that interest in mathematics has a strong correlation with achievement. It is worthy to note that there is a difference between "interest in mathematics" and "interest in contexts used in mathematics."

Bearing this in mind, I wanted to examine the relationship between the learner's interest and the contexts used in mathematics so as to help learners increase their interest in mathematics education. The need for this was evidenced by the weakness displayed by Korean learners in the international mathematics tests in terms of interest. One of the biggest barriers to good learning, as well as lack of interest in mathematics education, is the lack of relevance to real life situations.

This study was guided by the following:

1. Use of preferred contexts in teaching Mathematics in Korea.
2. Good mathematical modelling skills are important for technological advancements
3. Correctly motivating students creates a conducive environment for learning.
4. Improvement of application of mathematical concepts for solving everyday life problems.
5. To provide a theoretical insight into the relevance of mathematics education, as well as the context of the curriculum.
6. To provide information about values in mathematics through using the ROSME questionnaires.

The research is expected to have a significant impact on the development of Mathematics curricula for Korean scholars in grades 8-10 by:

1. Providing guidelines for schools on how to make mathematics more interesting.
2. Facilitating the development of various forms of support applications of mathematical concepts for solving everyday life problems.
3. Facilitating the increase in relevance of mathematics education in Korean grade 8-10 learners.

1.4 Aims of the research

The aims of the research include:

1. To develop the Korean youths perspectives with respect to school mathematics education, in real life situations.
2. To develop localised theory targeting the preferences of Korean youths from diverse socio-economic environments.
3. To obtain data on the preference of contextual situations Korean youth have and use these in future studies.
4. To investigate the motivations learners provide for their preferences.

This study was guided by the following objectives:

1. To identify Korean learners' most preferred contexts in school Mathematics
2. To identify Korean learners' least preferred contexts in school Mathematics
3. To identify Korean learners' middle preferred contexts in school Mathematics
4. To compare the most, the least and the middle preferred contexts between gender and between grades 8,9 and10

5. To investigate the relevance of Mathematics and Mathematical Modelling amongst Korean grade 8-10 learners.
6. To investigate the contexts that Korean learners in grade 8 to 10 prefer in dealing with Mathematics.
7. To investigate the change in TIMSS results from 2005 and 2010 for Korean grade 8-10 learners.
8. To investigate the differences between the results of grade 8 - 10 learners' responses to ROSME questionnaires in 2005 and 2010.
9. To investigate the relation between Korean grade 8-10 learners' TIMSS and ROSME results in 2005 and 2010.
10. To investigate the phenomenon with grade 8-10 learners' through interviews.

1.5 Problem Identification

The main research question for the research was: *what are the contextual situations learners in grades 8 to 10 prefer to deal with in mathematical literacy?*

1.6 Rationale and Motivation

Mathematical literacy deals primarily with the insertion of a mathematical gaze on mathematical issues and situations. These issues and situations are to a large extent determined by curriculum, learning resources and test designers. It is widely accepted that schools should graduate learners who are mathematically literate. Mathematical literacy has various definitions which overlap. A commonly accepted definition for this study is adopted from the Programme for International Student Assessment (PISA) (OECD 2001, p. 22) which defines mathematical literacy as 'the capacity to identify, understand and engage in mathematics, and to make well-founded judgments about the role that mathematics plays in an individual's current and future private life, occupational life, social life with peers and relatives, and life as a constructive, concerned and reflective citizen.' It is not difficult to conceive that mathematical literacy deals primarily with extra-mathematical contexts.

This places mathematical literacy within the realm of "applications and modeling of mathematics" viewed in a comprehensive sense as both 'modeling' [which] focuses on the direction reality mathematics and 'application' [which] focuses on the opposite direction

mathematics reality since “reality” as conceived here is essentially the extra-mathematical (International Programme Committee for ICMI Study 14, 2002).

The essential outcome for mathematical literacy is captured as “to make well-founded judgments and to use and engage with mathematics in ways that meet the needs of that individual’s life as a constructive, concerned and reflective citizen.” (OECD, 2000: 21). The outcome pivots around “needs” and is futuristic with “needs” determined by curriculum designers, learning resource developers and test constructors such as manifested, for example, the PISA test for mathematical literacy (OECD, 2000). As such the needs are assumed and considered as that for the “future” not-as-yet citizen.

Although there is some likelihood that the issues and situations being dealt with and tested in mathematical literacy will emerge in some analogous way in learners’ futures, it is necessary, from a motivational point of view, to get some sense of what issues and situations learners would prefer to deal with in mathematical literacy.

This study deals with a study focusing on the contexts in which learners would prefer to be embedded activities in mathematical literacy. The contexts that learners prefer to handle in mathematical literacy is relatively under-researched (Julie and Holtman, 2008). Many of the studies reviewed did not deal directly with the contexts learners would prefer to deal with in mathematical literacy. Some dealt with the effect of using contexts for mathematical concept formation, or the effect of the use of contexts on learners’ mathematical achievement and the ability of learners to identify mathematics in everyday activities (Dapueto and Parenti, 1999; De Bock, Verschaffel, Janssens, Van Dooren, and Claes, 2003). A study by Lepper (1988) comes close to the issue of “mathematics in context” approach which he contended promoted intrinsic motivation in learners. The shortcoming of these studies is that they did not deal with the use of contextual situations in school mathematics, but do refer to the contexts that learners prefer.

The major motivation for this study therefore is the seeming lack of evidence-based knowledge about contexts that learners would prefer to deal with in mathematical literacy; dealing with contexts that they would prefer and the realisation that learners from different socio-cultural environments might have different preferences for contexts.

1.6.1 Research questions

The following research questions are dealt with in this study:

What are the contextual situations Korean learners in grade 8-10 prefer to deal with in Mathematics classroom?

Sub- questions in this study include:

1. What is the nature of the motivations learners provide for selected contextual situation preferences?
2. How do the motivations mentioned above relate to contemporary social issues nationally and internationally?
3. How do the preferences expressed by learners differ or not across gender, location (including countries), socio-economic status and grades?

1.7 Limitations of Study

It is widely accepted that the purpose of qualitative research is not to test hypotheses, but is often a necessary precursor not only to design meaningful questions, but to generate future research questions (Werner & Schoepfle 1987a as cited in Carlson, Siegel & Falck 1995). Also, most times qualitative means is the only means to gather sensitive information about the way people perceive their actions and behaviour (Carlson, Siegal & Falck 1995).

In view of the above, a purposive sample method was employed in this study for the qualitative study. It should be noted that the approach and findings from this study cannot be compared with the existing quantitative findings, nor can it be used as a claim to represent population studies as a whole. Self-reported reasons provided in this study will not be 100% accurate and so will be regarded as faulty answers in the interviews.

1.8 Significance of the study

The study under review has significance for various fields.

1. The study will contribute to helping Korean youths in their perspectives with relation to mathematical education in real life situations.
2. It will highlight areas of need within their lives to understanding mathematical literacy.
3. Youth can understand values in educational mathematics.

4. It is a pilot study to inform parents, learners, educators, and allows for the design and implementation of more effective and need-based project.
5. It will have the ability to set parameters for future research by revealing unexplored research areas.
6. Findings could be useful to guide appropriate questions for questionnaires in future quantitative studies and qualitative interviews.

1.9 Summary of the Research Design

A survey design using questionnaires and interview questions was followed. This design was appropriate for the present study as its interest was unearthing what learners considered as relevant contexts for learning mathematics. Interviews have the advantage of revealing other topics for future study. The questionnaire contains 23 closed-ended questions and 7 cards. More details on the research design can be found in chapter 3.

1.10 Structure of the Present Study

Chapter 1: Introduction

The present study has the following structure:

Chapter one describes the background, motivation and aim of the study. The study based upon a brief examination of the Korean education system and a substantial exposition of learner-centeredness to provide an anchor for a ROSME study. The aims and objectives of the study and the outline of the research methodology are stated.

Chapter 2: Literature review

Chapter 2 presents an overview of literature relevant to the study, which is affective domain, The use of contexts in school mathematics, relevance of mathematics, mathematical literacy are also discussed. Finally some studies on learners' views are presented.

Chapter 3: The research methodology

Chapter three describes the methodology. It involves a combination of both the quantitative and the qualitative methods. It gives details on sampling procedures, data collection and analysis and/or techniques used.

Chapter 4 and 5: Chapter four and five deal with the interpretation of the findings. Both quantitative and qualitative data are presented here together with their analyses. Tables of summaries are presented and analyzed.

Chapter 6: Conclusions

Chapter six gives the conclusion and suggestions for further study. This is where I indicate the extent to which the research questions have been answered. The contribution of this study to mathematics education and towards the overall theory is also evaluated.



CHAPTER 2: Literature review

2.1 Introduction

Chapter one focuses on the contexts within which young Koreans would prefer learning school mathematics. Further to this, it is asserted that the applications of mathematics in real-life situations brings to the fore the notion of relevance. The topics in this chapter are “context” and “affective domain” related. Thus this chapter deals with the issue of relevance and how it relates to context and the affective domain of mathematics.

TIMSS is no longer marked by the ‘pure’ testing of curricular-bound knowledge, but is aimed at the functional application of mathematics in the context of the real world.

2.2 Affective domain

Affect is a wild area that includes values, beliefs, attitudes, emotions, mood and interest (Zan, Brown, Evans & Hannula, 2006). There is enough amount of literature on the importance of contexts to the affective domain in learning (e.g. Boaler, 1993a, 1994; Klassen, 2006; Clarke & Helme, 1998). Today’s complex society is in great need to learn mathematics for people’s development. Many learners’ feel mathematics is tiresome and become frustrated because of anxiety.

The pioneer in work on the affective domain in mathematics was McLeod (1989b). He referred to affective domain as a broad range of feelings and moods which are generally considered to be different from pure cognition. This will include specific components, attitudes, beliefs and emotions. Barton & Fairhall (1995) provides an argument for a re-think of mathematics curriculum and delivery by taking a historical approach.

2.2.1. Definition of Affective Domain

Many psychologists using the word “affect” explain it in varying constructs and processes that do not fit neatly within the cognitive umbrella. But educators have adapted “affect” to describe attitudes, beliefs, interest, self-concept, preferences. The affective domain is most simply defined as *feelings* which an individual feels about something (McLeod 1989b). In the context of mathematics, the affective domain was introduced to explain why learners who

possessed the cognitive resources to succeed at mathematical tasks still failed (Di Martino & Zan, 2001).

McLeod (1992) argued that three concepts such as beliefs, attitudes and emotions have to be investigated in the research on affect in mathematics education. DeBellis and Goldin (1997) added a fourth concept, values, in the study of affective domain. According to these four concepts, socio-constructivists say the social dimension of affect. According to Op't Eynde, De Corte, Verschaffel (2001), affect must primarily be grounded in and defined by the social context.

Traditionally, mathematics education deals more with abstract strategies; that is from the memorization of algorithms and rules, specific examples, and then to applications in the context. Mathematics in Context (MiC) is highly contextual in real-life situations to be used as a starting point for learning. MiC was developed in America (Villarrubia, 2001:8) and is similar to RME (Realistic Mathematics Education) in that it sees mathematics as a human activity and not as pure rules and principles to be learnt in isolated pieces. It sees mathematics rather as an entity that must be learnt through contexts. In this paper we will discuss the affective domain of mathematics education.

Most learners assert mathematics to be difficult, boring, and its learning mathematics must require special ability thus it is not meant for everybody. This kind of thinking influences high percentage of failures in mathematics as a subject. Many learners have a negative attitude towards mathematics although the course of their academic life.

2.2.2 Attitudes

Social psychologist Gordon Allport,(1935) defined attitude as “a mental or neural state of readiness, organized through experience, exerting a directive or dynamic influence upon the individual's, response to all objects and situations with which it is related” In other words, attitudes are psychological states acquired over a period of time as a result of our experiences; these attitudes influence us to act in certain ways and to respond to the world in

relatively consistent fashion. An attitude is not a response, but a readiness to respond in a certain way.

In a study conducted by Ajayi, Lawani, Salomi and Modupe (2012) on the influences of self-concept and academic motivation on students' attitude to mathematics in selected secondary schools in Ogun State in Nigeria, the results of their findings revealed that self-concept and academic motivation effectively predicted the attitude of students towards mathematics.

2.2.3 Beliefs

Beliefs according to (Colby, 1973: 253-54) are defined as judgments of the credibility of a conceptualization, "non-observable theoretical entities postulated to account for certain observable relations in human behavior". Rokeach (1968) perhaps the best-known researcher on the subject, defines belief as "inferences made by an observer about underlying states of expectancy. He explains a belief system as "having represented within it some organized psychological but not necessarily logical form, each and everyone of a person's countless beliefs about physical and social reality."

2.2.4 Emotions

For Gomez-Chacon (2000), emotional reactions are the result of discrepancies between what the subject expects and what he or she experiences when the reaction is produced in learning mathematics. Learners receive continuous mathematics- associated stimuli; they react emotionally, either positively or negatively. Such reactions are conditioned by their beliefs about themselves and about mathematics. If in response to similar situations, the same kind of affective reaction is produced repeatedly, the activation of emotional reaction (satisfaction and frustration...) could become automated and solidifies into attitudes. Positive attitudes and beliefs in learners will be reflected in improved performance and expectations of achievement in mathematics subject.

2.2.5 Values in mathematics

Rokeach has examined values, which he considers to be central beliefs, about how one ought or ought not behave, or about some state of existence which is worthwhile or not. Values are

abstract representations of positive or negative ideals of conduct or goals. Other researchers suggest that the value we place upon a task is a function of three components; the attainment value of the task, its intrinsic interest, and its utility value for our future goals (Eccles, & Wigfield, 2002).

1. **Mathematical values:** values which have developed as the subject in question has developed within that particular culture.
2. **General educational values:** values associated with the norms of that particular culture within a particular society, and of that particular educational institution. Mathematics educational values are embedded in curriculums, textbooks, classroom practices, etc. and such is as a result of the other sets of values.

Youths in Korea take time to study Mathematics and English. For a long time, Mathematics and English courses have been placed on a priority list because of their role in student development in South Korea. And as a result of this, the teaching methods have changed. In the 1970s, mathematics subjects were being taught for the entrance examination to study at a one step higher school. This entrance examination affected elementary school education for entering into middle school, middle school education for entering into high school and high school education for entering into university. In order to obtain higher marks for the entrance examination, students began learning to memorize multiplication and mathematical formulas. Since the 1990's, the educational policy has changed dramatically. Instead of memorization, emphasis has been placed on creating a paradigm in the system

Internationally, there is a high demand in learning mathematics for an individual's full development. Traditionally, Korean mathematics education has two significant problems, the context in mathematics education and the process of solving problems. In Korea, there has been an increasing concern with regards to the effectiveness of its mathematics education. The Korean education department has changed the mathematics policy many times in order to achieve the most effective mathematics education.

The curriculum is the single most important factor in ascertaining whether students will find mathematics both exciting and necessary. As Principles and Standards for School

Mathematics (PSSM) puts it, a school mathematics curriculum is a strong determinant for students to have the opportunity to comprehend what they learn. In a coherent curriculum, mathematical ideas are linked to and build on one another such that students' understanding and knowledge deepens and their ability to apply mathematics concepts expands (PSSM, p.14).

2.2.6 How can the Relevance of School Mathematics (ROSME) fit in the Affective Domain?

There is great need to solve the problem of what contexts learners would prefer when involved in mathematical education. In the ROSME 1 project held in 2005/2006, in order to raise the interest of pupils learning mathematics, it was important to know what attracts pupils or capture their interest in learning mathematics. A number of those factors have been highlighted here.

Firstly, the quality of mathematics education is often graded in terms of the types of mathematics that are worthwhile and adds values to both the student and society at large. Also it is about how to best support students so that they can develop their knowledge of mathematics.

There are many factors involved in the learning of mathematics. The factors are language, teaching skill, curriculum, learners' background, teaching materials, the role of the teacher, social influence, socio-economic structure and so on. According to McLeod (1989b), there are three factors that affect mathematics education: beliefs, attitudes and emotions. McLeod (1992) differentiated the four axes relating to beliefs: mathematics (the object), oneself, mathematics teaching, and the context in which mathematics education takes place (social context). In addition to this, Goldin (1997) added another element; values.

Researcher are interested in why Korean learners achieve good results on the TIMSS, PISA international mathematics competitions, even though they do not show they are interested to study mathematics and yet they still study hard. Julie (2007) argues that though students are sometimes interested in learning mathematics, that interest should not only come from students. However, incorporating students' interest in the curriculum is not sufficient. School

mathematics curricula where the contextual interests of students, teachers, parents and designers of curriculum and learning resources are balanced, needs to be given considered.

Several studies have been conducted using the ROSME questionnaire. Among these are: (Julie & Mbekwa, 2005; Barnes, 2006; Snyders; 2006; Cornelissen, 2008; Blaauw, 2009; Lebata, 2006; Van Schalkwyk, 2007; Ngcobo, 2011; Kacerja, 2011, and Kim, 2006). Other ROSME studies such as (Julie, 2006 and van Schalkwyk, 2007) investigated teachers' positions on the context for learning school mathematics.

Julie, Holtman and Mbekwa (2011) presented "Rasch modeling of Mathematics and Science; teachers' preferences of real- life situations to be used in mathematical literacy", and in this article they used the ROSME instrument. The ROSME asserted the real-life situations of which the teachers most and least preference were to be included in mathematical literacy. This was to provide useful information for policy-makers and textbook authors on contextual issues to be included in learning materials.

Holtman, Julie, Mtetwa, Ngcobo and Mbekwa (2011) reported in their findings a comparison of preferences for real-life situations that could be used in school mathematics in three Southern African Development Countries (SADC). The results can inform cross-country assessments designers of school mathematics curricula, such as the SACMEQ (Southern and Eastern Africa Consortium for Monitoring Educational Quality, SACMEQ is a collaborative network of 15 ministries of education, launched in 1995 and Ministries of education have joined together to improve the quality of education), about appropriate real-life situations which appeal to learners that can be used in these comparative assessments.

In Kacerja's (2011) presentation of Albanian students' motives for preferring certain real-life situations for learning mathematics, she asserted that an important mechanism uncovered played an important role in mathematics topics introduced. The degree of difficulty of the mathematics influenced the choice of preferred contexts by students. Julie & Mbekwa (2005) conducted their ROSME project at a public school in the Western Cape in South Africa as they used mean scores to rank the contexts as least, and most preferred.

In their research they found that the five highest ranked contexts were; *mathematics that will help me do mathematics at universities and technikons; mathematics involved in making computer games; mathematics involved in sending of messages by SMS, cellphones and e-mails; mathematics involved in determining the state of health of a person and mathematics to assist in the determination of the level of development regarding employment, education & poverty of my community.*

The five lowest preferred were: *mathematics linked to decorations such as the house decorations made by Ndebele women; mathematics for determining the number of fish in a lake, river or certain section of the sea; mathematics involved in working out the best arrangement for planting seeds; mathematics to predict whether certain species of animals are on the brink of extinction and how to estimate and project crop production.*

Another research study was carried out on Grades 8–10 by Barnes (2006) in the Western Cape, South Africa where the aim of his research was to compare the most and the least preferred contexts of the three grades for learning school mathematics. Barnes used 20 schools of poor socio – economic backgrounds as sample. Sample size of study was 1 177. Barnes used mean ranks to determine the most and the least preferred contexts and his findings showed that, *mathematics that will help me do mathematics at universities and technikons, numbers, mathematics involved in secret codes such as pin numbers used for withdrawing money from an ATM, mathematics that is relevant to professionals such as engineers, lawyers and accountants, the kind of work mathematicians do, and mathematics involved in working out financial plans for profit making* were amongst the ten most preferred contexts for all three grades.

In all three grades *mathematics that will help me do mathematics at universities and technikons* was rated highest. The least preferred grades were *mathematics of lottery and gambling, mathematics involved for deciding the number of cattle, sheep or reindeer to graze in a field of a certain size, mathematics involved in packing goods to use space efficiently and mathematics involved in working out the best arrangements for planting seeds with mathematics of lottery and gambling.* He reports that intra-mathematical and extra –

mathematical clusters were ranked highly while the agriculture and political clusters were ranked low.

In Swaziland Ngcobo (2006) conducted her study in a context in which forms 2 to 4 (grades 9 to 11) in some private schools prefer to learn mathematics. Data for that study were collected using the ROSME questionnaire. The target population for the study was secondary school learners from private high schools that offer the International General Certificate of Secondary Education. One class from each target group (2-4) took part in the study. Factor analysis was used to obtain subgroups of the items using the learners' responses. Emerging groupings were *fun and entertainment, health & environment, mathematics and mathematicians, technological and socio-economic issues*. Frequency counts were used to find the most preferred and the least preferred items.

Ngcobo's findings showed that the five contexts in which learners were mostly interested were: *mathematics that will help them do mathematics at universities and technikons; mathematics that is relevant to professionals; mathematics involved in secret codes; mathematics involved in working out financial plans for profit making and mathematics involved in the sending of messages by SMS, cell phone and e-mails*. Except for the last one, each of the above contexts had a median of 4 and an interquartile range of 1 indicating that at least 75% of these learners had a strong preference for the more preferred contexts. Results from the open-ended item indicated an emphasis on the interest of these contexts. The five contexts in which learners were least interested were: *mathematics involved in designing delivery routes of goods; mathematics involved in working out the best arrangement for planting seeds; mathematics involved in deciding the number of cattle, sheep or reindeer to graze in a field of a certain size; mathematics used in decorations on mats and handicraft made by the market ladies; mathematics needed to work out the amount of fertilizer needed to grow a certain crop*. The popular reasons given for interest in contexts were curiosity, career prospects and financial freedom in the future.

Lastly Kim (2006) conducted similar research in Korea. In her case the most preferred contexts were; *mathematics that entertains and surprises us; mathematics involved in*

determining the state of health of a person; mathematics involved in sending messages by SMS, cell phones, and e-mails; mathematics about the age of the universe and mathematics involved in secret codes such as pin numbers used for withdrawing money from an ATM. The least preferred contexts were; *mathematics used to calculate the number of seats for parliament given to political parties after elections, geometry; mathematics involved in working out the best arrangements for planting seeds, algebra and mathematics needed to work out the amount of fertilizer needed to grow a certain crop.*

Teachers who attended continuing professional development teacher education courses at the University of the Western Cape in Cape Town, South Africa were surveyed for their views on contexts relevant for learning school mathematics (Julie, 2006). These were mathematics teachers (36), language teachers (25), other subject teachers (70) and 13 primary school teachers. They all ranked *health* amongst the five highest ranked items while *military matters* and *lottery and gambling* were ranked amongst the five lowest ranked items.

Van Schalkwyk (2007) compared teachers' data from South Africa with data from Korea. The teachers chose from among 20 contexts. The teachers chose their five least preferred contexts they deemed appropriate for Grades 8-10 learners comparable between the two countries to include: *mathematics of lottery and gambling; mathematics in military matters; mathematics linked to rave and disco dance patterns and mathematics in political matters such as the allocation for parliament given to political parties after elections.* While South Africa included *mathematics involved in sending messages by SMS, cell-phone and e-mails*, Korea included *the kinds of work mathematicians do* as their fifth least preferred context. From van Schalkwyk's results the five most preferred contexts are presented in table 2.1. The highest ranked context in the table is the first on the list.

Table 2.1 Comparison of South African and Korean teachers' preferences for contexts

Most preferred contexts	
SA	Korea
Mathematics that will help learners learn mathematics at university and technikon	The mathematics of making bridges, airplanes and rockets
The use of mathematics in issues about health such as mathematics to prescribe the amount of medicine a person must take; mathematics used to describe the spread of diseases such as HIV/AIDS	The placement of emergency such as police stations, fire brigades, ambulance stations so that they can reach emergency spots in the shortest possible time.
The mathematics in making bridges, airplanes and rockets	Mathematics that will help learners to understand how decisions are made about the sustainable harvesting of natural resources.
The mathematics to assist in determination of the level of development regarding employment, education and poverty of their community	The mathematics of inflation
The placement of emergency such as police stations, fire brigades, ambulance stations so that they can reach emergency spots in the shortest possible time.	To do their mathematics with calculators and computers

ROSME authorizes learners to choose the contexts themselves. Due to their different backgrounds, learners bring to the learning situation varied views about knowledge (Pillay, 2002). Differences of learners in the same class occur in a variety of ways. In Korea it is possible to find learners from different economic backgrounds in the same classroom. Some learners might come from poor financial backgrounds, others from middle and rich financial background and sometimes a few from foreign countries. There are some practical issues that need to be weighed up when considering the use of learning contexts offered by learners as

they could be interested in different contextual situations for learning school mathematics. A democratic approach would be to consciously take into consideration their most and least preferred contexts when planning a curriculum that accommodates their views. This consideration emphasizes the importance that adults' voices can input as to what contexts to be used.

Learners' preferences and voices are taken into account so as to avoid the least preferred contexts and to uphold the most preferred ones. Consulting them on contextual issues to be incorporated in the curriculum acknowledges them as important members of the school community. However, with the number of learners in a class it would not be practical to consider each individual learner's interest when planning for learning.

2.3 Youth

The next sections look at Youth and youth and health, technology because the learners who participated in this study are regarded as youth (grades 8-10) and youth are influenced largely by popular culture.

According to Schreiner (2006:43), the concept of "youth" can be defined in various ways. Youth may be defined as an age, a mentality, a generation, a phase of life, a social and cultural construction (Flacks 1971, Furlong and Cartmel 2007, Wyn and White 1997). This definition changes across cultures and time (Aagre, 2003; Coleman & Henry, 1999; Fauske & Oia, 2003; Fronès, 1998; Heggen, 1993, 2004; Illeris *et al*, 2002; Miles, 2000). The Free Dictionary defines a youth as any person being between the ages of 13 and 25. In the late modern youth category, a youth is "the transition from childhood to adulthood, the development of one's own identity, and spending much time with peers in educational institutions. The Korean learners of grades 8-10 in this study can therefore be referred to as youths rather than young people.

Youths find it difficult to adapt to social changes, values and principles, and therefore one can easily find pronounced differences between age groups. Youth culture is making sense of cultural expressions of the age in which young people live. Youth actively develop the

culture among themselves, and adults' direct influence on the process is limited or absent. Youth culture can comprise linguistic expressions, attitudes and taste, and consciousness for example clothes, music and style. The expressions of the youth culture are often influenced by the agenda of popular media. Youth culture is locally differentiated and often forms distinct subcultures within the youth community”.

People have different opinions as to whether the attitudes and values of youth will last throughout their lives or whether it will disappear. However, a popular view is that some values will last for that phase of life, and will vanish as a youth grows older. The values of that specific youthful generation will remain, and these values will have the potential of changing society in the future. Sociologists often assume that values that are developed at the young stages are likely to survive through other phases and influence them for the rest of their life (Frones, 1998; Hellevik, 2001). Therefore, attitudes and values held by youths are often seen as a cultural mirror image of the future” (Fauske & Oia, 2003).

The 2002 survey of young Australians showed that their attitudes and achievements are determined at ages 27-28. This is also a reflection of their own journeys, since the study began in 1991 (Dwyer *et al*, 2003).

Dwyer *et al.* (2003) conclude that the post-1970 generation is generally positive. In 2002 as many as 91% of youths expressed real satisfaction with their own personal development. Youths change priorities easily, and look at the old and new in making sense of their world. Most of them feel that they have made the right choices. They are maintaining the right balance, and challenging themselves. In this way they are practicing how to express life for themselves.

Youths are spending more time with each other in educational institutions. They are developing good relationships based on this. The traditionalization, individualization and good relations in the educational institutions are contributing toward the development of youth culture (Frones, 1998; Heggen 2004). The next aspect of this discussion delves into the things that youths are interested in.

2.3.1 Youths and work

The global economic crisis hit youth very hard; in the two years to the second quarter of 2010, unemployment in the age group 15-24 increased by almost 6%, more than twice as much as for adults (2.5%) (TUAC, 2010). Only Germany managed to slightly reduce its already relatively low youth employment while the highest increase was recorded in Spain, followed by Ireland, then the Slovak Republic, Greece and Iceland.

As a result, youth unemployment rates currently exceed 25% in seven countries namely Finland, Greece, Ireland, Italy, the Slovak Republic, Sweden and with Spain having more than 40% of youth unemployed. By contrast, the youth unemployment rate is still at 10% or less in eight other countries (Austria, Germany, Japan, Korea, Mexico, the Netherlands, Norway and Switzerland).

According to TUAC news (2010), the global economic crisis hit youth very hard. In the two years to the second quarter of 2010, unemployment among young people aged 15-24 increased by almost 6%, more than twice as much as for adults (2.5%). Only Germany managed to slightly reduce its already relatively low youth employment while the highest increase was recorded in Spain, followed by Ireland, then the Slovak Republic, Greece and Iceland.

The OECD launched a new project focusing on job creation for youth in 15 member countries namely: Belgium, Canada, Denmark, France, Greece, Japan, Korea, The Netherlands, New Zealand, Norway, Poland, the Slovak Republic, Spain, the United Kingdom and the United States of America. (OECD, 2006b) For many youths, finding a paid job is the central task, and the status of the work, be it formal or informal is of less importance. The key criteria for assessing their experiences therefore tends not to revolve around the prestige of the job, but whether or not they are treated fairly by the employer, which often implies being treated with respect or in a friendly manner (White *et al.*, 1997).

In contrast, youths who worked in the post-teenager years have clearly established a tendency to place a priority on gaining the mix of work experience and qualifications that would enable them to be flexible. This enables them to exercise a certain amount of control over their lives

under conditions of employment uncertainty. In the year 2002 survey with participants aged 27-28, the life patterns study found that these views had become more definite.

In western countries, youths and under 15's are restricted from paid work by law by the education departments. Mckenie and Hobbs (2002) conceptualizes the costs and benefits of employment by balancing between the costs and benefits. The costs are bad health and safety, limits free, time negative effect on education, instrumentalism, less parent/peer contact, whereas the benefits are good-autonomy, self-reliance, economics/business; knowledge, work experience. They argued that although everyone will condemn exploitative and harmful work practices, some employment has the potential to provide the youths with benefits both socially and financially (McKechnie and Hobbs, 2002: 240). They point out that children can benefit from the work-education relationship and we should not restrict work in childhood.

2.3.2 Leisure and recreation

The study of leisure is justified under the notion that participation in leisure activities promotes greater life satisfaction and well-being. Leisure is perceived primarily as a positive force that enhances the lives of individuals and society as a whole (Kelly & Godbey, 1992). Life satisfactions and well-being are generally conceptualized and assessed in terms of happiness, satisfaction, morale, quality of life, self-esteem, mental and physical health.

Leisure, according to Veal (1992:45), is a block of unoccupied time, spare time, or free time when we are free to rest or do what we choose. Leisure is time beyond that which is required for existence, the things which we must do biologically, to stay, alive (that is eat, sleep, eliminate, medicate, and so on); as well as subsistence, the things we must do to make a living (such as work, or prepare to make a living as in schooling, or pay for what we want done if we do not want do it ourselves). Leisure is time which our feelings of compulsion should be at minimal. It is discretionary time, the time to be used according to our own judgment or choice.

Leisure refers to any structured or unstructured activity that is freely chosen constructively and undertaken in an individual's own free time. It has a strong social element and includes sports, recreation, art and cultural activities. Involvement in leisure activities increases

physical, mental and social skills, and can contribute to a sense of connectedness to the community by enhancing opportunities to establish positive social support and networks.

Generally in Korea, students and parents working in the post-teenage years are between the ages 20-25 years old. But few youth in their teenage years are interested in youth experiences and sociology of youth.

Work gives many benefits namely; income, a source of social connection. Through these, youths will learn skills, gain knowledge and personal growth. Work can be fun, boring, frustrating, invigoration, challenging. Sometimes young workers experience not only exploitation through wages but also harassment, discrimination, poor working environments, irregular hours and income, bullying.

2.3.3 Leisure activities and youths

Leisure and recreation is more important to youth than any other group. Through leisure activity, they can acquire many experiences, different life styles, activities, identities and social groups. In leisure and recreation, they find positive self-images, increased school performance and engagement in educational institutions. Also they can find mental health and social development. Youth leisure is a needed area of research (Cuerro &Wyn, 2006: 4). Gold Coast City Council Research (2003) has shown what young people currently do for leisure, which are characterized as a three-age related stage are:

- i) organised leisure - including sport participation declines from 13 to 14 years of age.
 - ii) casual leisure - including hanging with friends is common at the age of 16.
 - iii) commercial leisure - going to the cinema and dance clubs becomes the norm from age 16.
- Overall, in Australia, youths under the age of 14 years spend their time watching television or videos (98%), reading for pleasure (75%), playing video/computer games (71%), participate in organised sport (62%). Those of ages 13 and 17 have an array of leisure interests but they spend most of their time watching TV, listening to music (CDs and radio), and hanging around with friends. Music is popular to young Australians, depending on their attitudes and lifestyle, their musical tastes become different. Music expresses youths identity. They prefer being in the company of friends rather than spending time with family. Youths

frequently expressed a general distaste for leisure activity particularly if organized by adults or school.

Youths of age 15 to 24 have the highest participation rate (90,4%) in exercise, recreation and sport as compared to any other age group. Most popular activities include aerobics/fitness, swimming and walking. Although youths enjoy organized sport, casual and recreational sport, they do not frequently participate in it as compared to them watching TV or playing computer games.

In Korea, as well as every other western country in the study, being educated is more important for youths. According to the study of OECD member countries, 97% of South Korea's youths completed their secondary school. Parents urge youths to finish secondary school as this has resulted in a higher completion rate recorded in the country. Ninety percent (90%) of youths who finish secondary school will continue into tertiary education. Some youths work part time while studying. From this point of view, schools form merely a small part of a youth's complex life.

2.3.4. Health and Wellbeing and Youth

Young people in Korea and other western countries in this study are eagerly attending schools at top levels than in the past years, but parents worry about their health. Research shows that youths have interest in their health and wellbeing. Beck and Beck-Germshiem (2002) argue that youths become individualized thereby raising concern about their own health and wellbeing.

Education and employment ranks more important for youths when making decisions as they transit from youth to adulthood, though this is not to say that mental health is not important. It is merely a call for concern amongst youths.

2.3.5 Technology and Youth

In modern society, technology has become a part of our daily and social life. This is so to enable people to interact and communicate better. In the last 10-30 years, there was rapid and

extraordinary expansion of technology. The development of new media is an important counter for the social shaping of technology (Flew: 2002: pp. 53).

New media provides youth on demand access to information on topics they prefer on devices they choose to use. It allows them to be part of virtual communities and to participate creatively. Wikipedia, an online encyclopedia, is one of the best examples of the new media which allows for this combination of participation, collaboration, publication and dissemination between community of editors and donors.

2.4 The Use of Contexts in School Mathematics

2.4.1 Mathematics in Context

The term context has many meanings and uses in school mathematics education. Mathematics education for mathematical literacy is also related to Mathematics in Context (MiC) which is a comprehensive mathematics curriculum. MiC as earlier stated was developed in America in connection with the RME in the Netherlands. As in RME, the basic idea of MiC is that mathematics is a human activity in society. Mathematics does not concern pure rules and principles to learn in isolated pieces. It must be learned through contexts.

According to Villarrubia (2001:3), the key focus of MiC is on connections; connections among topics, connections to other disciplines, and connections between mathematics and meaningful problems in the real world. MiC emphasizes the dynamic, active nature of mathematics and the way mathematics enables learners to make sense of their world.

Traditional mathematics education deals more with abstract strategies, that is from memorizing algorithms and rules to specific examples, and then to applications in context. By contrast, MiC is highly contextual. Mathematics is a tool to understand the real world objectively.

Mathematics originated from real life and so MiC uses real-life situations as a starting point for learning. This means learners are immediately able to engage with real life problems. MiC minimizes the abstract learning and maximizes the concrete learning which is applicable to society namely, increasing mathematical literacy. Thus the real goal of MiC is to make

learners solve non-routine problems in any mathematical situation they encounter in their daily lives (Villarrubia, 2001: 8).

2.4.2 Mathematical Literacy in Korean Mathematics Education

2.4.2.1 Mathematical Literacy in Korean Mathematics Curriculum

The curriculum of Korean mathematics education has had many revisions in the past but it still does not use the term mathematical literacy. According to Lew (2004: 1), the 6th curriculum was revised for mathematical literacy:

The 6th mathematics curriculum issued in 1993 was designed for mathematical literacy education for all in order to cope with very rapid social change of the 21st century by emphasizing mathematical problem solving ability and application of mathematics. Computer and calculator as an instructional tool, and various teaching and evaluation methods were supported. But there were few educational efforts to support the successful realization of the slogan. The more recent content and approach used in textbooks were not different from the past. The verbal method of instruction without any technological support continued as well as the focus on assessment of knowledge (that is 'testing'). As a result of this, the mathematics curriculum goals of learners could not be attained.

In 1998 the 7th mathematics curriculum was produced in response to the movement of mathematics education throughout the world, particularly in the USA. This new curriculum is different from its predecessor mostly because it makes use of terms such as “mathematical power,” instead of “mathematical literacy.” Thus the foundational principle of the 7th curriculum is to enhance mathematical power required in the 21st century. Mathematical power includes the ability to explore, conjecture and reason logically; to solve non-routine problems; to communicate about and through mathematics; and to connect ideas within and between mathematics and other intellectual activity. Mathematical power also involves the development of personal self-confidence and a disposition to seek, evaluate and use quantitative and spatial information in solving problems and making decisions. Learners’ flexibility, perseverance, interest, curiosity and inventiveness also affect the realization of mathematical power (National Council of Teachers of Mathematics, 1991:1).

2.4.2.2 Mathematical Literacy in Korean Text Books

Korea has two educational periods: a compulsory period of 10 years from grade 1 to grade 10 and an elective period for 2 years from grade 11 to grade 12. Mathematics curricula are developed corresponding to these divisions. The compulsory period has only one subject called “Mathematics,” while the elective period has six (6) subjects that include: Practical Mathematics, Mathematics I, Mathematics II, Calculus, Probability and Statistics and Discrete Mathematics.

In the textbook designed for the 7th Korean mathematics curriculum for the compulsory period, there is no special room for mathematical literacy. A direct relationship to mathematical literacy is in the ‘Practical Mathematics’ which is part of the elective period and thus this practical mathematics subject is optional. It is mathematics designed for daily life.

This subject enables learners to apply mathematical knowledge and skills to various types of real life problem situations. The content of this subject focuses on the application of mathematics in four domains (see Table 2. 2) namely: the calculator and the computer, economic life, everyday statistics and problem solving. The content uses easy and interesting material from real life situations based on mathematics but at a stage lower than the 10th grade level.

Table 2.2: Contents of Practical Mathematics (Paik, 2004)

Domain	Contents	
Calculator and Computer	Calculator	Functions of the calculator / use of the calculator
	Computer	Functions of the computer / simple programming / use of computer software
Economic living	Banking	Interests / saving instalment and loan instalment
	Insurance	Medical insurance / car insurance
Everyday statistics	Arrangement and summary of a set of data	Various graphs and tables / mean and variance
	Application of probability statistics and	Concepts and application of probability / expected value / application of binomial distribution / poll
Problem solving	Optimization	Linear programming / optimization

	Problem solving	Problem solving in daily life / problem solving through the computer
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One of the characteristics of the Korean Secondary Mathematics Texts (KSTM) is the presence of contextual tasks. The text provides a variety of contexts to develop the understanding of mathematical concepts and basic skills. Real life situations from other areas have been integrated into learning tasks to foster the learning of fundamental mathematical concepts and skills.

Figure 2.1 is an example of an activity taken from one text that illustrates the teaching of the concept of the set. The definition of ‘set’ is hard to understand as it is an abstract concept. Yet it is the first concept learners learn when they enter middle school (grades 7 to 9). As a result, a set plays an important role in the onset of secondary school mathematics. The activity in Figure 2.1 attempts to teach this concept by use of the fact that most learners are familiar with an array of musical instruments and the manner of classifying them.

“Many musical instruments produce beautiful sounds thus:

1. Find all the string instruments.
2. Find all the wind instruments.
3. Find all the instruments producing big sound.
4. Compare the answers, if there is something that seems different, think about the reason why.”



Figure 2.1: A definition of set in a contextual task

Many learners can separate the string instruments from other musical instruments and consequently, they can recognize the differences between ‘string instruments’ and ‘instruments producing big sound’ as a standard for classifying musical instruments. The former enables one to explicitly classify musical instruments while the latter cannot. KSMTs writers designed an assortment of contexts that deal with explicitness in classification, only after a formal definition of set has been presented (Lee, 2004).

Figure 2.2 reflects a real-life phenomenon; that is, a cellular phone monthly charge. Learners are required to fill in the given table, develop equations for finding call charges, make a graph of all the equations in the same coordinate plane, and finally find intervals that make each method of charge the most economical (Lee, 2004).

“Figure 2.2: Contextual task related to real-life phenomena

There are several ways to calculate monthly charges for a cellular phone. The company named Startelecom presented the following charge options available to customers

Opinions	Basic fee (Won)	Fee per 10 sec (Won)
Economy	9000	15
Super	12000	10
Royal	16800	5

(1) Fill in the below table and select the most economical way for each time.

Options	40min	80min	120min	160min	200min
Economy					
Super					
Royal					
The most economic					

(2) Let x represent time in minutes, and y represent the call charge in 100 won⁸. Develop equations for finding the computation of call charges. (Let represent call charge options, respectively)

(3) Make graphs of all equations on the same coordinate plane. Based on the graph, find the most economical range of time for each charge option.”

In conclusion, as indicated in the 7th curriculum of Korean mathematics education, it employs the concept of mathematical power instead of the concept of mathematical literacy. There is actually no difference between these two concepts. In reality, KSMT contains a lot of mathematics in context.

In TIMSS 2003, teachers said that although 50% of classroom activity is related to daily life situations, learners answered only 17% (Mullis *et al.*, 2004:281-282). It seems true that learners would have difficulties in using real-life problem situation contexts as real life data are not simple. It would not have been a problem if calculators or computers were being used adequately, but most Korean secondary schools are still not satisfied with these standards (Lee, 2004).

The high achievement of Korean learners in international competitions such as TIMSS encourages educators to develop a higher level of mathematics curricula and textbooks, and to provide more efficient mathematics teaching methods. The Korean mathematics education community recognizes that mathematics is the most important and the most basic intellectual resource that its people can use to build up the new society.

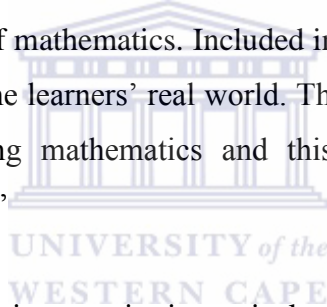
Realistic Mathematics Education (RME) is one theory that has given prominence to contexts in the learning of school mathematics. Its context-driven nature makes it a suitable component of a motivational theory for the present study. It is characterized by the following: the use of contexts; the use of models; the use of students own productions and constructions; interactivity; and the intertwining of various learning strands (Zulkardi, 1999).

⁸ Won (₩) is Koran currency. About 180 won at the present time is equal to about 1.00 rand.

The present study examines the nature of the categories of contexts that learners prefer to use in the learning of mathematics, to also include their perceptions on the use of other school subjects as contexts for learning mathematics. The contexts investigated have a potential to provide an appropriate environment to promote the five characteristics of RME. In RME a learner is portrayed as an active participant in the learning situation.

Romberg & Meyer (2001, p. 3) assert that, “connections are a key feature of the program—connections among topics, connections to other disciplines, and connections between mathematics and meaningful problems in the real world”. Mathematics in Context emphasizes the dynamic, active nature of mathematics and the way mathematics enables students to make sense of their world.

The quotation above renders all the contexts included in the ROSME questionnaire used in this study useful in the learning of mathematics. Included in ROSME are mathematical topics while the others are contexts in the learners’ real world. The real world includes other school subjects as contexts for learning mathematics and this links with the MiC’s idea of “connections to other disciplines.”



The strength of RME comes from its capacity in vertical mathematizing; to transform known mathematics into contexts for learning more mathematics. One criticism against learning in contexts is that some traditional school topics such as algebra, geometry, functions and trigonometry are rarely found in the everyday life experiences of learners (Usiskin, 1997). In such cases RME as a theory becomes useful as mathematical knowledge acquired earlier becomes a context in which higher level mathematics can be learnt. Cobb (2000) also emphasizes experiential contexts as one of the views central to RME.

2.5 Relevance of mathematics

2.5.1 Definition

Relevance has been a much discussed concept in the last few years Romberg asserts that the emphasis should be on “mathematical knowledge put into functional use in a multitude of different situations and contexts in varied, reflective and insightful ways” (2001: 5). Carol

Damian (2001), stated the following:

Recently, I was chatting with 15 young people and asked them why a person should study math in school. They gave reasons as being well-rounded, getting into college, challenging oneself, being with friends in classes, and choosing courses taught by teachers they like. Then I probed further by paraphrasing the two big questions: “Do you think you’ll ever use that stuff? Why should you have to learn all that maths?” Some of them mentioned things like balancing cheque books, converting litres to gallons at the gas pump and learning how to make slime. “Well”, I asked, “do you suppose anything you’re learning in maths and science will ever come up in your everyday lives or in your future jobs?” “Yes”, one girl answered, “like when you change a bunch of stuff on your credit card and find you’ll never be able to pay it off at the humongous interest rate.” I asked them if any of their classes prepared them for that kind of real-life shock. They all said they were not sure because the lessons seemed disconnected from anything real. I asked the two big questions again, “When will you ever use that stuff? Why learn all that math and science?” They thought a while, talked among themselves, then started rattling off these “reasons”: banking/borrowing money, product consumer, family planning, waste disposal, car purchases (and energy/pollution concerns), transportation systems, global warming, safety, medicines, genetic engineering, politics, defence, issues, earthquakes, usable water, food supplies, weather changes, materials for building and clothing, disabilities, understanding numbers and problem-solving, communication, computers, and information gathering. I was fascinated. These students were quite capable of answering their own questions. More than that, they were defining what it means to be literate in mathematics and science. They were closing in on what is relevant in maths and science in their lives now and in the future. When students ask you the two big questions, ask them to help you

think through the answers. As they respond, they will realise how important mathematics and science literacy is to all of us.

In the quotation above Damian probed learners' perceptions with regard to what is relevant in mathematics. Many of the answers given by students in Damian's study were used as items in the Relevance Of School Mathematics Education (ROSME, 2005) questionnaire which formed part of my study and few studies have been conducted using the ROSME questionnaire (Julie & Mbekwa, 2005; Barnes, 2006; Ngcobo, 2006 and Kim, 2006). Other ROSME studies such as Julie, 2006 and van Schalkwyk, 2007 investigated teachers' positions on the context for learning school mathematics. Questions about the relevance of an institution, an activity, or a subject are often asked and less often answered.

According to the free dictionary (Farlex, 2005), the definition of relevance is "pertinent to the matter at hand," or "its applicability to social issues." To illustrate further, relevance must refer, at least implicitly to a relationship with some body of values or purposes. Thus a subject may be relevant in the first instance by way of its applications to another subject. This in turn may be tested for a further relevance, ultimately to human welfare or to an overriding conception of good.

The everyday use of arithmetic and the display of information by means of graphs are an everyday practice. Arithmetic is the elementary form of mathematics. Advanced mathematics is widely used, but often in an unseen and unadvertised way. In short, the relevance of mathematics involves both the various applications of mathematics and the position of mathematics in the spectrum of human values.

2.5.2 Importance of Mathematics

The importance of mathematics is becoming more recognised in the 21st century society. President Ronald Reagan of the United States of America, for example, proclaimed the week of April 14 through April 20, 1986, as National Mathematics awareness week. In his speech he mentions that; *"despite the increasing importance of mathematics to the progress of our economy and society, enrolment in mathematics programs has been declining at all levels of*

the American educational system. Yet the application of mathematics is indispensable in such diverse fields as medicine, computer sciences, space exploration, the skilled trades, business, defence and government. To help encourage the study and utilization of mathematics, it is appropriate that all Americans be reminded of the importance of this basic branch of science to our daily lives (Reagan, 1986)."

Ever since, mathematics awareness week has continued at the local, state and regional levels in the United States. Its main aim over the years was to draw attention to the field of mathematics and thereby educate a larger audience on its relevance, intrigue and power⁹. In 1999, mathematics awareness week became "Mathematics Awareness Month."

The importance of mathematics has led to many school timetable periods being allocated to mathematics. It is now obvious that the skills learned in secondary school mathematics are being used a lot by many people. This is despite a tremendous increase in the sophistication of the society, which has led to an explosion of mathematics use by a few at a higher level in science and social science, technology, industry and government.

It has been reported that learners have problems relating their well-developed manipulative skills to realistic context problems in real-world situations, as secondary mathematics lessons put much emphasis on computation and algorithm skills (Boyce, 1994; Hubbard, 1994; Lew, 1999; Kwon, 2002). The question then becomes: how do instructors teach learners mathematics in such a meaningful way as to foster learners' mathematical growth. Mathematics is a powerful learning tool. When learners identify relationships between mathematical concepts and everyday situations, and make connections between mathematics and other subjects, they develop the ability to use mathematics to extend and apply their knowledge in other curriculum areas, including science, music and language¹⁰. Therefore, through mathematical activities that are practical and relevant to their lives, learners develop mathematical understanding, problem-solving skills, and related technological skills that they

⁹ <http://www.pims.math.ca/education/everywhere/> on 15 May 2006.

¹⁰ <http://www.mathaware.org/about.mam.html>. retrieved on 2006/03/25.

can apply in their daily lives and, eventually, in the workplace. But in order to use mathematics effectively, it will require a wide range of skills than is traditionally taught in schools; that is the skills of mathematical modeling.

2.5.3 Mathematical Modeling

The aims of mathematics education should be linked to the social, political or pedagogical issues that affect people's lives. For this, mathematics education must employ mathematical modeling because the knowledge of mathematical modeling has a potential to increase learner's ability to apply mathematics to the real world that is the real world outside of mathematics. In other words, involvement of mathematical modeling enhances learner's competences in their daily lives.

Mathematical modeling is a part of mathematical literacy programming; a powerful instrument of communication between the real world and the mathematical world and it is also one of several ways of solving real problems.

2.5.3.1 Definition

“Model” is a description of a system, theory or phenomenon that accounts for its known or inferred properties and may be used for further study of its characteristics. By extension, a mathematical model is a mathematical structure that can be used to describe and study a real situation. According to Aris (1979:1), a mathematical model is any complete and consistent set of mathematical equations thought to correspond with some other entity: its prototype. In this definition, the term “prototype” represents any physical or conceptual entity. It may also represent another mathematical model. Mathematical modeling is the process of using various mathematical structures, such as graphs, equations, diagrams, scatter plots, tree diagrams and so forth, to represent real world situations. The model provides an abstraction that reduces a problem to its essential characteristics.

2.5.3.2 Types of Models

According to Davis and Hersh (1986), there are three types of models and they are classified on the basis of the purposes they serve. They are:

1. Descriptive models - constructed to describe an existing reality as accurately as possible.
 2. Predictive models - describe a section of reality, but in this case it is a state that does not yet exist.
 3. Prescriptive models - intends to give guidelines for the construction of a section of reality.
- The distinction between these models is the perspective each takes. Some models might even contain all three perspectives.

2.5.3.3 Modeling Process

Mathematical modeling deals with reality-based contextual examples. According to Kaiser (2005), a modeling process is done on the basis of the following ideal-typical procedure as shown in Figure 2.3.

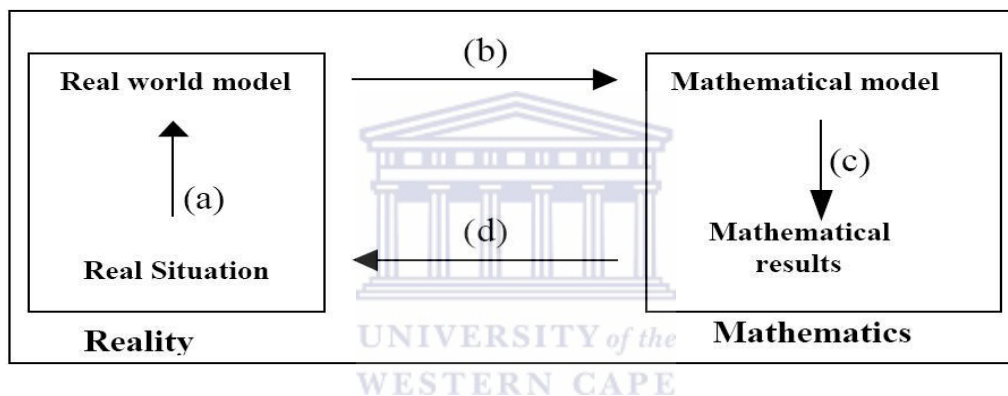


Figure 2.3: A modelling process (Kaiser, 2005).

The first step: a real world situation is the process's starting point. The situation is idealized (named (a) in figure 2-3), i.e. simplified or structured in order to get a real world model.

The second step: this real world model is mathematized in (b), i.e. translated into mathematics so that it leads to a mathematical model of the original situation.

The third step: mathematical considerations during the mathematical model produce mathematical results at point (c) which must then be reinterpreted into the real situation at point (d).

The fourth step: the results' adequacy must be checked, i.e. validated. In case of an unsatisfactory problem solution, which happens quite frequently in practice, this process must be repeated.

2.5.3.4 Modeling in Korean Mathematics Education

One of the aims of the 7th curriculum of the Korean Mathematics Education is to foster mathematical modeling abilities through solving various problems posed within and outside mathematics. Mathematical modeling consists of mathematically analyzing, representing, solving and reinterpreting problem situations. Therefore mathematical modeling is offered in most KSMTs. It is based on interconnections between mathematical topics and the

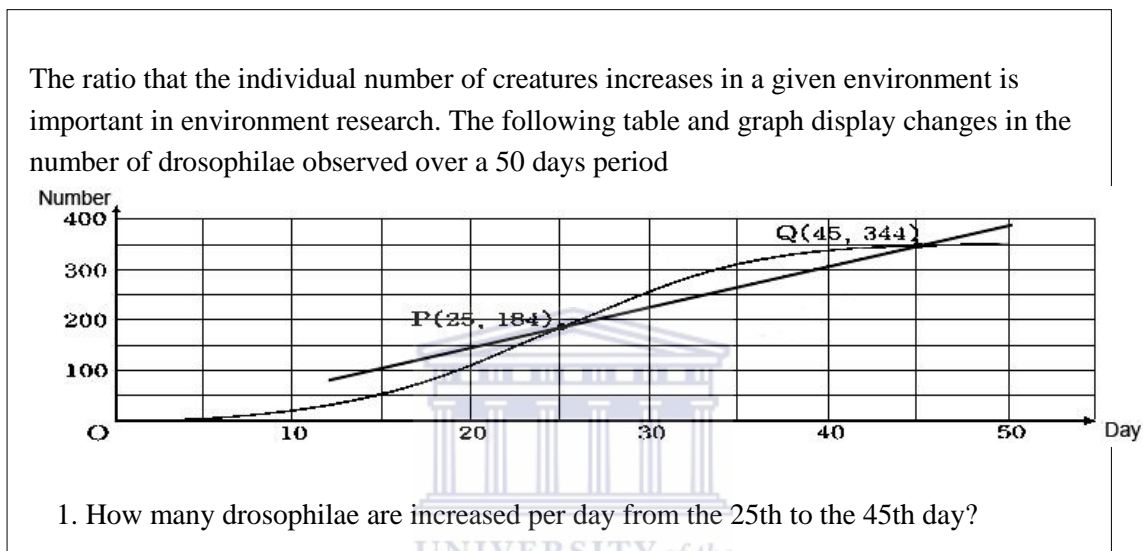


Figure 2.4: A problem for mathematical Modeling

connection that exists between mathematics and other subjects. For example, in Figure 2.4, learners may be required to study environmental problems by observing the number of drosophilae flies for 50 days, using a table and graph to represent the observed changes, and re-analyzing the problem situation (Lee, *et al.* 2002).

2.6 Mathematical Literacy

2.6.1 Definition

Literacy of any type is often defined in similar terms, ultimately meaning “using printed and written information to function in society” (Kirsh and Jungeblut, 1986). More broadly the term “literacy” refers to the human use of language (Gee, 1998). With this, a simple connotation of mathematical literacy is the human use of mathematical language in daily life.

Since mathematical literacy was introduced in the 1980s, it has been defined in a wide variety of ways over the past few years. Everyone more or less has come to agree that mathematical literacy cannot be defined in terms of mathematical knowledge only and that it focuses on individual competencies in using mathematical knowledge in a practical and functional way. PISA/OECD (2003:24) offers the definition as follows: *“mathematical literacy is an individual’s capacity to identify, to understand and to engage in mathematics and make well founded judgments about the role that mathematics play, as needed by an individual’s current and future private life, occupational life, social life with peers and relatives, and life as a constructive concerned and reflective citizen.”*

It is apparent in the work done by Julie and Mbekwa (2005) that mathematical literacy deals primarily with contexts. The South African education department defines mathematical literacy using its perspective as: *“to provide learners with an awareness and understanding of the role that mathematics has 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 solve problems.”* (Department of Education, 2005:7).

Jablonka (2003) identifies five functional approaches to mathematical literacy. They are mathematical literacy for (i) developing human capital, (ii) cultural identity (iii) social change, (iv) environmental awareness and (v) evaluating mathematics. She argues that the fifth approach should be the focus of mathematical literacy as it would allow learners to critically engage with the mathematical installations in society.

2.6.2 Purpose of Mathematical Literacy

Modern society has changed rapidly and become an information-driven society with new social goals. Because of these new goals, today’s society expects learners to become mathematically literate, to extend their learning, to have equal opportunities to learn, and to become informed citizens with a better understanding in this technological society. Therefore, the National Council of Teachers of Mathematics (NCTM) (1989:5) established five goals for mathematical literacy: (1) that learners learn to value mathematics; (2) learners become

confident in their ability to do mathematics; (3) they become mathematical problem solvers; (4) they learn to communicate mathematically; (5) and they learn to reason mathematically.

Across the world, there is evidence that many adults are not able to do much but the simplest arithmetical calculations. They struggle to calculate percentages or interpret interest rates and graphs. The implications for such lack of understanding and facility are far reaching. People are exploited by biased reporting and advertising and are ill-equipped to make responsible financial decisions. The pervasive presence of handheld calculators and computers makes it critical that people understand how to interpret results of calculations and that they are able to decide logically what mathematics to use. In general, the mathematics learnt in school is not transferred to other contexts.

The teaching and learning of mathematical literacy should thus provide opportunities in analyzing problems and devise ways to work mathematically in solving them. Opportunities to engage mathematically in this way will also assist learners to become astute consumers of the mathematics reflected in the media (Department of Education, 2005:8).

According to the National Curriculum Statement of South Africa, the purpose of mathematical literacy is to provide learners with opportunities in which they can engage with real life problems in different contexts, and so consolidate and extend basic mathematical skills; to equip learners with the ability to understand mathematical terminology, and make sense of numerical and spatial information communicated in tables, graphs, diagrams and texts; to develop the use of basic mathematical skills in critically analyzing situations and creatively solving everyday problems; and to enable the learner to become a self-managing person, a contributing worker and a participating citizen in a developing democracy (Department of Education, 2005:7). Here a self-managing person refers to one who is capable of managing mathematics in everyday life. A contributing worker is one who deals with work-related finance and statistics, and a participating citizen is one who has the ability to communicate mathematically.

In summary, mathematical literacy aims to develop four important abilities (Department of Education, 2005:8):

1. The ability to use basic mathematics to solve problems encountered in everyday life and

in work situations.

2. The ability to understand information represented in mathematical ways.
3. The ability to engage critically with mathematically based arguments encountered in daily life.
4. The ability to communicate mathematically.

2.6.3 Importance of Mathematical Literacy

Romberg (2001:5) argues that in 1989 when the NCTM used the term “mathematical literacy,” it referred to mathematical knowledge and skills that are not defined within the traditional school mathematics curriculum. It is about individual competencies in using mathematical knowledge in a practical and functional way. In this context, mathematical literacy has become the primary focus of mathematics education.

Thus mathematical literacy implies functional use of mathematical knowledge in a multitude of different situations and contexts in varied, reflective and insight-based ways. Therefore, mathematical literacy is not merely literacy but it becomes a subject which learners must learn in school. In this regard, South Africa is the first country where mathematical literacy has not only become a subject of the regular curriculum for senior secondary education but it has relationship with reality. Mathematics is relevant to society and thus has human value.

Consequently, Freudenthal (1973) explained mathematics education to be an activity called mathematization, which he defines as a process of maximizing the understanding of the concepts of a mathematical model within the learner’s mind.

Freudenthal (1991) and Treffers (1987) further divided mathematization into two different types of mathematical activity. One activity is the horizontal mathematization which involves moving from the context of the practical problem towards the mathematical context of articulating and solving the problem. The other is vertical mathematization leading to the creation of new associations between the learning tools, as well as new structures. These two forms of mathematization are of equal value. Furthermore one must keep in mind that mathematization can occur at different levels of understanding.

2.7 Summary and Conclusion

In this chapter I presented theoretical views on affect and contexts. On affect, special attention was given to interest. General issues on the use of contexts in school mathematics were discussed. Some research studies on consulting learners were reviewed. Lastly studies that have been carried out using the ROSME questionnaires were presented.

A number of studies on mathematics contexts and education focused on the use and effects of contexts in the teaching and learning of mathematics. Thus, those studies were on the effectiveness of contexts in the learning of mathematics. None of the studies asked the learners about their preferences of contexts to be used. Boaler (1993b) says one criticism on contexts used in mathematics classrooms was that they are extracted from the adult world and learners might not identify with them. The present study consulted learners on contexts they would prefer to use in learning mathematics. It drew from the other studies in that it presented the learners with contexts to choose from, but differed in that it privileged their originality by asking them to state any three contexts they mostly preferred to use for learning mathematics. The research questions of this study were: What contexts learners most preferred? What contexts they least preferred? What reasons they gave for the most and least preferred contexts?

In this section, I described and discussed the affective domain, youth, contexts in mathematics literacy, relevance of mathematics, mathematical modeling and mathematical literacy. In doing so I alluded to how far youths' attitudes towards mathematics can be supported, and in connection with this, what competencies are needed for modeling and solving real world problems. How can these competencies and modeling can be developed by innovative projects aimed at the integration of modeling and real world examples in everyday teaching.

In today's society people understand the relevance of mathematics in everyday life. Both elementary and advanced mathematics are often widely used in an unseen and unadvertised way. Furthermore, the relevance of mathematics involves both the various applications of mathematics and the position of mathematics in the spectrum of human values. However, it

is generally accepted that mathematics education focuses on teaching and learning mathematical knowledge and skills which are isolated from contexts. Thus today's society is characterized by the absence of mathematical literacy.

Since mathematics has spread throughout the Korean society, there is no discipline, from daily life to the rocket manufacturing industry that does not use mathematics. Korean society requires mathematical literacy for its people. In order to enhance the application of mathematics in real life situations learners have to learn mathematics. These contexts are also related to their interest in studying mathematics. Mathematics education in my opinion must be built on the understanding of learner's culture, background, and interest. This research study fills the gap in the literature in that it tries to explore ways to make mathematics and mathematics educators better equipped to meet the youth culture, priorities and concerns.

Previous research by this researcher (Kim, 2006), learners' interest, culture, and background were not deeply explored as the questionnaires were merely administered to learners for their responses. This research was aimed at trying to understand Korean sociological perspectives on modernity, youth culture, and late modern identity construction. It is assumed that social environment has a major influence on youth orientations towards mathematics at school.

In perspective, the ROSME questionnaires are appropriate for research on the interest that the youth have for mathematics and the contexts they prefer. In the past 50 years, a gradual progress of academic interest in popular culture was made possible through increased scholarship and gradual transformations of formal curricula. The ROSME II questionnaire was thus revised to include the concepts of modern youth, popular culture, and certain items were also updated. Two (2) intra-mathematical clusters are mathematics and mathematicians' practices. 11 extra-mathematical clusters are health, physical science, technology, general, finance, transport and delivery, life science, sport, youth and culture, politics, agriculture.

The methodology for achieving this will be discussed in the next chapter.

CHAPTER 3

3.0 Methodology

3.1 Introduction

This chapter deals with the methodology used in this study. It focuses on how the researcher went about exploring the issues and the contexts preferred by Korean grade 8-10 school learners for learning mathematics. A combination of quantitative and qualitative methods formed the base of this study. The ROSME II questionnaire and interviews were the primary data collection tools. The choice of a questionnaire in a survey approach was appropriate as the sample involved a large number of learners, namely, 1640 learners. Twenty five learners were interviewed.

The chapter includes the research design, a motivation for the quantitative and qualitative approaches, the sampling procedure, the pilot study and its evaluation, recommendations for the main study and the instruments for the main study. Also included are the reliability and validity procedures for both quantitative and qualitative research, ethical considerations, the research procedure and the data analysis procedures.

3.2. Research design

The researcher used an induction research strategy and collected attitudinal data related to various contextual situations to be dealt with in mathematical literacy. For this, the relevance of School Mathematics Education (ROSME), developed by a group of teachers and mathematics educators (Julie, 2005; Julie & Mbekwa, 2005) was revised and used.

According to Julie and Holtman (2008), a 61-item questionnaire was used to collect data in Zimbabwe, Uganda, Swaziland, South Korea, South Africa and Norway. Ndemo (2006), Mutodi (2006), Ngcobo (2010), Kim (2008) and Julie (2007) report on the results of the implementation in Zimbabwe, Swaziland, South Korea and South Africa. The entire data set of the six countries was analysed by Julie and Holtman (2008) using the Rasch analysis procedures. They concluded that there were redundancies in some item subsets where the

replacement by an appropriate single item would not be sufficient enough to affect the validity and reliability of the instrument. Through a series of discussions between the mathematics educators and post-graduate students from Zimbabwe, Swaziland, South Korea, South Africa and Albania, the questionnaire with 61 items was reduced to 23 items. All the items of this instrument dealt with extra-mathematical situations amenable to mathematical treatment and the responses learners provided to the 23 items were used in the study.

It is important to be aware of the range of research methods available and to understand how they work, appreciating their advantages and disadvantages. The range of basic research methods is relatively small. One other advantage about research methods is that it is possible to combine them to give added dimensions to the research project.

This study employed quantitative and qualitative research methods. The study involved a combination of a survey of student preferences towards mathematics and interviews with the learners to investigate learners preferred contexts in handling mathematics. The combined approach allowed the researcher to understand the contexts which Korean grade 8-10 learners would prefer when learning mathematics.

3.2.1. Motivation for quantitative and qualitative approaches

The use of both quantitative and qualitative methods minimizes many of the limitations of using only one approach. The choice of quantitative or qualitative methods for any study depends on the purpose of and the research questions of the study. Quantitative and qualitative (or naturalistic field research) are different research methods applied in different ways, though they complement each other in several ways (Guba & Lincoln, 1981). The advantage of using both quantitative and qualitative methods is that they enhance the gathering of rich data. The rationale behind this was that I felt that the questionnaire could provide a wide range of answers to any given set of questions, though the answers may be superficial in nature. This could then be overcome by supplementing the questionnaire with in-depth interviews with a smaller sample group. Through this, it is possible to give the research the required scope and depth. Data collection techniques therefore included questionnaires and interviews and data triangulation was achieved.

Qualitative methods include observations and interviews. In observations, the researcher systematically watches, listens to and records events, behaviours, phenomena of interest in the social setting chosen for the study (Marshall & Rossman, 1995). By observing the actual behaviour of individuals in their natural setting, one may gain a much deeper and richer understanding of such behaviour (Strydom, 2001b). A suitable agenda for studying classrooms involves observation and talking to teachers in order to understand the meanings of their actions through interviews.

Patton (1990) clearly explained the circumstances under which interviews are suitable saying,

...we interview people to find out from them those things we cannot directly observe. We cannot observe feelings, thoughts, and intentions. We cannot observe behaviours that took place at some previous point in time. We cannot observe situations that preclude the presence of an observer. We cannot observe how people have organised the world and the meanings they attach to what goes on in the world. We have to ask people questions about those things (Patton, 1990,p.196).

The purpose of interviewing is to allow us to experience the subjects perspective. On the other hand, quantitative techniques provide information to such questions as, '*who?*', '*what is?*', '*when?*', and '*where?*' in numerical form. Although figures and numbers provide quantitative information that is useful, they do not always provide adequate explanations. Figures and numbers do not always provide answers to questions about '*how?*', '*what?*' and '*why?*' certain things happen the way they do (Neuman, 2000). In this study the data collected using the questionnaire, were suitable for quantitative analysis. At the same time the interviews provided the opportunity to ask *what, why, and how* questions about the learners preferred context.

3.2.3. Sampling

According to Korean law, education is an obligatory duty amongst the four different duties. Other obligations for every Korean is the duty to pay tax, join the army and labour. Children of ages seven must enrol at primary school where they will receive free education. Following this, the average ages of grades 8, 9 and 10 learners are 16 years old, 17 years old and 18 years old respectively. According to our survey, only a few learners in rural and on the

islands break this norm by enrolling into schools at an older age. The difference in the number of such cases (rural and island dwellers) was negligible, it was therefore ignored.

According to the Korean school system, grades 7 to 9 is middle school and grades 10 to 12 is high school. Grade 10 is at a different stage as compared to grades 8 - 9. According to the 7th revision of the curriculum, mathematics education has 10 steps from grades 1 to 10. Learners in each stage must be taught 10 basic common subjects including mathematics. At these stages, there is no repetition or logical jumps in the mathematics subject. According to the 7th curriculum, the mathematics curriculum has 6 fields that includes; 1) numbers and operations, 2) algebraic language skill and formulas, 3) functions, (4) probability and statistics, 5) geometry, and 6) measurement.

For this study I used both the simple random and the cluster sampling methods. Simple random sampling selects samples that allow each possible sample to have an equal probability of being selected and each item in the entire population will have an equal chance of being included in the sample. Cluster sampling selects a random sample of these clusters or groups of the population (Levin, 1978:182).

As stated in Chapter 2, the ROSME II project focuses on students in the 8th to 10th grades. These are the last two years of compulsory schooling and the start of the final school phase in most countries. For the current study, data from Korea were collected from 26 schools in the 11 regions ranging from the urban capital city, Seoul, to poverty-stricken rural and island areas. These regions were classified into three clusters. For the selection of schools in each region, simple random sampling was employed. In total 1839 students (1 missing data reported) comprising 1000 females and 838 males participated in the study. There were 611 students from grade 8, 386 from grade 9 and 842 from grade 10. The age ranged from less than 17 years (611 students), 17 years old (428 students), and above 17 years old (799 students). The total number of learners are represented in Table 3.1.

Table 3.1: Demographic information: Korean Sample

LOCATION	1	500	
	2	594	
	3	745	1839
GRADE	8	611	
	9	386	
	10	842	1839
GENDER	1(Female)	1000	
	2(Male)	838	
	Missing	1	1839
AGE	16	611	
	17	428	
	18	799	
	Missing	1	1839

Note: 1 =Metropolitan; 2= City group and 3= Country side group

3.2.3.1 Metropolitan Group

The metropolitan city group is the first category. In this study, the first group consists of only three metropolitan cities: Seoul, Pusan and Daegu metropolitan city. The population of each of these metropolitan cities is over 2.6 million. Their combined population is over 17 million, which is approximately 35% of the total Korean population. Korea currently has an estimated 48 million people. The total number of participant learners in this study coming from the metropolitan area was 500 (from eight different schools). This is approximately 28% of the total number of participants in this study.

The educational system of this metropolitan group is the best among the three groups. Well-known universities are situated in the metropolitan area. The high competency levels evidenced in these schools enables most of their final year learners to enter the best universities. Along with this, the level of the learners' parents' education is also very high and thus their enthusiasm to have their children attain high levels of education.

Learners are more likely to study with private tutors or at private institutes, which offer entrance exam-oriented study. Almost all the families in this group have access to highly developed IT systems with internet access requiring high speed optical cables. The financial

status of most families in this group is better than the other two groups. Most of the parents prefer an urban lifestyle as to a rural one.

3.2.3.2. City Group

The second category is the city group. For this study, this group consists of the 11 cities. The population of each city varies from 170,000 to 1.5 million. This survey used 594 learners from 7 schools constituting 39% of the total number of participants. As in the first group, most families in this (city) group have internet access connectivity using high-speed cables. The financial status of families in this group is average when compared to the other two groups. Most learners' parents in this group prefer that their children live in an urban rather than rural area, and most of them want to send their children to universities for further study.

3.2.3.3. Country Side Group

The third category is the country side group which includes rural areas and islands. For this study the number of participating learners was 745 making up approximately 33% of the total number of participants. Their financial status is the lowest amongst all the groups, as most of them do not have private tutors for extra lessons. Rather learners in this group are frequently involved in helping their parents' with work. For instance learners in agricultural areas are familiar with working in the fields whilst those on islands are usually involved with fishing or engaged in seaweed farming etc. They also have access to high speed cable internet.

3.2.2. Instrument

The data collection instrument was a questionnaire (Appendix I) for the quantitative study. One reason for the use of a questionnaire is that questionnaires can elicit a faster response about pupils' preferences. With completed questionnaires, it is faster to get an idea of learners most preferred or least preferred options. It is relatively easy to get learners' response rate since the questionnaires require less effort to complete. The questionnaire used was based on the first ROSME project where its analysis indicated that a reduction in the number of items would not affect the validity of the questionnaire (Julie & Holtman, 2008).

3.2.2.1. Questionnaire

Questionnaire surveys are probably the most commonly used and misused research method. Questionnaires are extremely flexible and can be used to gather information on almost any topic from large to small numbers of people. Questionnaire surveys do however have their problems. It is not easy to design and even well-designed ones do not always manage to produce a high rate of response.

It is imperative that the questionnaire should have a direct relationship to the problem under investigation, as well as to the specific goals and objectives of the research project. Only pertinent questions should be incorporated. Many of the problems can be overcome relatively easily. It is worth looking at the two main types of questionnaire and the uses for which they are designed.

The vast variety of questionnaires used in research and survey work can be classified in a number of different ways. Young (1956: 177) classifies questionnaires into two kinds: *structured* and *non-structured*.

Structured questionnaires contain definite, concrete and pre-ordained questions with additional questions limited to those necessary to clarify inadequate answers or to elicit a more detailed responses. The questions take the form of either *closed* or *open*. A closed or forced-choice question is one where a number of alternative answers are provided from which respondents are to select one or more. An open-ended question is one where respondents formulate their own answers. The important point is that they are stated in advance, not constructed during the interview.

Structured questionnaires are used in a wide range of projects, both to initiate a formal inquiry and also to supplement and check data previously accumulated. The purpose of the inquiries may be to obtain social or economic information, measure opinion on public issues or events, study administrative policies and changes etc. Extensive use of the structured questionnaire is found in studies involving about the cost of living, consumer expenditures, child welfare, public health, and investment practices.

The most common type of questionnaire is one with closed questions. Here the respondent is asked a question and required to answer by choosing between a number of alternatives, hence another given to such questionnaire type is multiple-choice questionnaires. The main advantage of this type of questionnaire is that they are easy to complete and easy to analyze. They provide a range of answers and thus reduce the chances of the respondent overlooking something. They also reduce the possibility of obtaining ambiguous answers.

Closed-ended questionnaires can only really be used to obtain fairly straight-forward, uncomplicated information. When it comes to collecting information about differing shades of opinion, the format of multiple-choice questions ceases to be appropriate. Similarly, problems arise both for the respondent and the analyst when a question calls for a combination of answers. To overcome some of these problems, researchers use the open-ended questionnaire. Here the onus is placed on the respondent, who is expected to formulate and record answers in his or her own words. This has obvious limitations. It is only effective when used by people who are eager to express themselves in writing and doing so succinctly. It produces a wide range of answers which are often very difficult to categorize and analyze. It does little to ensure that valid answers are not overlooked. Lastly, it requires more effort from the respondent and is thus less likely to be completed.

Despite these limitations, open-ended questionnaires can, under the right conditions, produce detailed answers to complex problems. They are most effective when used in the survey of a relatively small sample size of people who are eager to express themselves in writing; who have a particular interest in the subject of the survey and who are likely to have reasonably similar opinions on the matter. It is, of course, possible to devise questionnaire that combine both open and closed questions, according to the nature of the subject. Indeed, it is often desirable to follow a closed questions, with an open one to obtain any additional and relevant information.

A source of error in questionnaires could be the respondents' inability or unwillingness to respond accurately or simply because of inaccurate question-wording. To prevent this, the

following were suggested by Babbie (1973), Blalock (1970), Steinberg & Philcox (1983) and Walker (1985):

1. establish an appropriate level of phrasing
2. employ simple language and words familiar to all respondents
3. avoid ambiguous words or phrases
4. questions should be as specific as possible
5. avoid leading questions
6. take the differences in frame or reference between researcher and respondent into consideration
7. take into account potential memory and recall failures when posing questions relating to past events

Questionnaires are cheap, relatively flexible and can be used to reach a very large number of people. They can be designed to provide a degree of anonymity or to enable the researcher to follow up certain points at another time. The questions are all presented in a consistent format and style and there is little scope for bias to be introduced by different researchers. Linked to this is the fact that the survey is impersonal and avoids some of the problems which can develop during the interaction between an interviewer and a respondent. The questionnaire can also be completed at the respondents' own pace, and the respondents can, if so desire, look through the whole questionnaire before committing themselves to anything; this avoids the problem of respondents beginning an interview by answering in a very defensive way.

The main disadvantages include the lack of qualitative depth to the answers and the resulting superficiality, in particular. This method also allows for very little development or amendment as a result of lessons learned in the early stages of the research. For this reason it is extremely important to pre-test and pilot-test questionnaires, not only to ensure that the questions are unambiguous and answerable but also to check that nothing has been overlooked.

3.2.2.2 Types of forced-choice response formats

According to de Vaus (1994:88-89), there are five kinds of forced-choice questions:

- a) Likert-style formats for rating scales: this approach involves providing people with statements and asking them to indicate how strongly they agree or disagree. In the present

study, there are four categories within the Likert format namely: 1) very high interest, 2) high interest, 3) low interest and 4) nil/zero interest.

b) Semantic differential formats: this format consists of choosing adjectives to represent the two extremes of a continuum and asking respondents to put a mark between the two extremes. An example is;

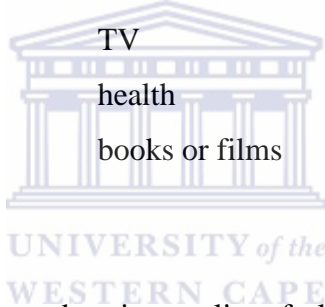
How would you describe your mother?

Warm	1 2 3 4 5 6 7	Cold
Lonely	1 2 3 4 5 6 7	Not at all lonely
Dominant	1 2 3 4 5 6 7	Submissive

c) Checklist: this consist of a list of items and respondents are asked to circle each relevant item. An example is:

What things do you talk to your mother about?

Sport	food	relatives
Religion	jobs	TV
Neighbours	feelings	health
Marital problems	garden	books or films
Children	hobbies	
Weather	politics	



d) Ranking formats: respondents can be given a list of alternative answers, but rather than selecting between them they are asked to rank their importance.

e) Attitude choices rather than agree-disagree statements: although the agree-disagree question format is one of the most widely used, it can suffer from the ‘acquiescent response set’ problem where some people agree with the statements regardless of their content. One way of avoiding this is to provide a number of alternative views and ask respondents to select the view that is closest to their own.

3.3. Questionnaire of ROSME I

The ‘Relevance of School Mathematics Education’ project, or in brief, the ROSME project, is an international comparative project inspired by the science and scientists project and its extension, the Relevance of Science Education (Julie and Mbekwa, 2005:32). The questionnaire was developed from 2003 to 2005. More detail is found in chapters 1 and 2.

3.4 Questionnaire of ROSME II

The ROSME II project focuses on students in the 8th to 10th grades. These are the last two years of compulsory primary schooling and the start of the final school phase in most countries. The survey method was used and as Pring (2004, p. 37) put it, ‘surveying does not depend upon an outside observer’. It takes into account the views of learners that are the ‘objects’ of the research. With surveys, one can get answers from a large group of learners. There are criticisms against using surveys but as Pring (2004) asserts, ‘the meanings which the respondents attribute to the questions are not something private and subjective, but the meanings which anyone conversant with the language would attribute to them’ (p. 39). Respondents were requested to express their interest on 23 items representing different contexts to be used in mathematics lessons on a 4-point Likert scale ranging from ‘very high interest’, ‘high interest’, ‘low interest’, ‘nil/zero interest’. Further details of the questionnaire are found in Chapter 1 and 2.

3.4.1 Korean Translation of Questionnaires

The original ROSME II questionnaire was developed in English in South Africa (see Appendix I). The Korean version of the questionnaire was based on this English version (see Appendix II). Researcher translated the English version into Korean in May 2008 and the first version was corrected by a mathematics teacher. The second Korean version has been modified by another mathematics teacher and cross-checked with the English version in October 2008.

Notable things in the translations were that two items in the English version were translated according to the Korean context (C with numbers such as C1 and C21 refers to the number in the questionnaires). C13, ‘mathematics linked to South African pop music’ was changed to ‘mathematics linked to pop music.’ C2, ‘mathematics linked to decoration such as the house made by Ndebele women’ has been translated into ‘mathematics linked to Korean traditional games such as “yut.”¹¹

¹¹yut is a Korean traditional game played on New Year’s Day using four sticks. Markers and a board are needed to play “Yut,” Players, divided into two teams, toss the sticks in turn and move the markers around the board according to the position in which the sticks land on the ground. The objective is to get all the team’s markers around the board and home before the opposition.

3.4.2 Pilot Study

Gorard (2001) stated that, it is important to conduct a pilot study before going to the real data collection, especially for novices, in order to be aware of the difficulties that might arise. A pilot study was done in the middle of March, 2009 with 30 learners, comprising 15 boys and 15 girls in grade 8 in the city region in Korea. The class teacher instructed learners to mark all items and then observed their behaviour while they were answering the questionnaire. Subsequently a few questions were given to the class teacher and the teacher brought back those questions to the researcher.

One of the questions, as example, was based on the agricultural cluster. Korean learners cannot even imagine the agricultural situation appearing in the questionnaire since agricultural land possessed by a farmer in Korea is of small size. This type of question was somewhat awkward to them; however, the questionnaire has not been modified because the researcher thought that the questionnaire is common to an international study standard.

3.5 Data Collection: quantitative data

In the data collection process, the researcher verbally informed each learner before the data collection process of the aims, objectives and benefits, voluntary participation, and grade criteria (grades 8-10) in April 2010. Confidentiality and anonymity were guaranteed and researcher reminded the learners that their consent to participate could be withdrawn at any stage of the data collection process.

Questionnaires were administered in May 2009 to all willing participants and the researcher was presented to assist with completion where needed. The data collection process was changed occasionally depending on school situations. The data for this study were collected from May to June of 2009.

The researcher obtained permission from participants and the class teachers through face-to-face conversation and via telephone. The researcher explained to the teachers that learners must be encouraged to answer all the questions. This encouraged the teachers and probably would have resulted in the proper completion of the questionnaires. The questionnaires were sent to either the class teacher by post or delivered by hand and subsequently returned to the researcher in August 2009.

3.6 Data Analysis: quantitative data

3.6.1 Rasch analysis of ordinal data

The Rasch model was developed by a Danish scientist, George Rasch, as a system of data analysis, utilized for the evaluation of an instrument's reliability, validity and to create measures that could be used for parametric testing (Rasch, 1980). This probabilistic model is a vital tool for researchers to monitor and develop the functioning of scales. The model is widely utilized and generally accepted in a variety of settings such as the in the third international mathematics and science study, in health related studies, as well as in medical education.

Rasch analysis can be applied when carrying out an assessment of a wide variety of academic disciplines, such as health studies, marketing, education, psychology, economics and social sciences. By comparing the traditional analysis techniques, Rasch analysis can be used to analyse and improve a test instrument because of its ability to generate linear (interval strength) scores. The Rasch model constructs linear, interval scale measures of latent variables by placing item location on a common scale (or metric) using log-odd units or logits.

The Rasch measurement model is useful for determining the utility for the assessment of a test item (or group of items) what it contributes towards estimating a person's level of ability on an underlying construction or latent trait (Andrich, 1988; Rasch ; 1960; Wright and Stone, 1979). Data were analysed using Rasch procedures. These procedures are recommended for rating scale analysis (Bond and Fox, 2001). Rating scales of the kind used in this study normally ignore the fact that the response categories are not necessarily linear in the sense that the distances between subsequent responses are not equal. Rasch procedures solve this

problem by transforming the data so that the linearity issue is addressed. In Rasch modelling, a model is not sought to fit the obtained data. Various statistics are reported when Rasch analysis is used, and for this project these statistics were obtained using the Winsteps programme.

Rasch analysis and procedures are not discussed in this chapter and the reader is referred to the references for further information regarding Rasch analysis of ordinal data (Bond and Fox, 2001; Linacre, 2008; Reeves and Fayers, 2005). The present study utilizes twenty three closed questions in the ROSME II questionnaire. Rasch techniques were chosen to obtain and analyse the data. The data obtained for this research was analyzed by the Statistical Package for the Social Science (SPSS), version 17.0 computer programme.

According to Rasch modeling, total score summarizes a person's position on a variable, originating from a fundamental requirement: that the comparison of two people is independent of which items may be used within the set of items assessing the same variable. It can be posited that the model at this juncture is considered as a “criterion for the structure of the responses which they should satisfy, rather than a mere statistical description of the responses.” For example, if the work of two students were marked by different graders in order to make a comparison of the two students. In such a situation it is alleged that the researcher is developing items that are valid, so that he or she meets the requirement of the Rasch model.

Using the Rasch model, data can be analysed to give a range of detailed information that act as a check and balance to ascertain whether scores are justified in the data. This is usually regarded as “the test of fit between the data and the model”. Taking the total score of a person does not hold especially where the invariance across different groups of persons fails to agree. The data must first fit the model perfectly, although this is sometimes difficult. “If the data does fit the model adequately for this purpose, then the Rasch analysis also “linearises” the total score, which is bounded by 0 and the maximum score on the items into measurements.

Many assessments in these disciplines involve a well-defined group of people responding to a set of items for assessment. Generally, the responses to the items are scored 0 1 (for two ordered categories) or 0, 1 2 (for three ordered categories); or 0, 1,2 3 (for four ordered categories) and so on. This indicates increasing levels of a response on some variable such as health status or academic achievement. These responses are then added across items to give each person a total score. This total score summarizes the responses to all the items and the person with a higher total score is deemed to show more of the variable assessed. Summing the scores of the items to give a single score for a person implies that the items are intended to measure a single variable, often referred to as a “unidimensional variable.”

A researcher who intends to use the total score on a test or questionnaire should apply the Rasch analysis to assess each person on a summary bases. The contrast here, however, is between the Rasch model and the Traditional or Classical Test Theory which also utilizes the total score to summarize each person’s score. While the Rasch model follows mathematically from the requirement of invariance which gives a comparison among persons and items, the Traditional Test Theory alleges that the total score is merely asserted as the relevant statistic.

The analysis provides evidence of anomalies with regards to; the operation of such items which may over discriminate or under discriminate, where groups of two or more items may reveal Differential Item Functioning (DIF) and those anomalies with respect to the order of their categories; where the anomalies do not form a threat to the validity of Rasch model or the measurement of the structure, then people located on the same linear scale as the item; locating items on the continuum allows for clearer understanding of the behaviour of variables at different parts on the scale. Furthermore, where persons are placed on the same scale, it provides a better understanding of the performance of persons in relation to the items. The procedures have been applied and are generally recommended for analyzing ordinal scales (Bond and Fox, 2001). According to Linacre (2008), Rasch model constructs “linear measures from ordinal observations.” The probabilistic nature of Rasch model explains how a person may endorse an item of a scale dealing with a latent variable is predicted by the person’s endorsement of the scale.

The Rasch modeling is not sought to fit the obtained data, rather the model is considered as the ideal model and the quest is to determine how closely the data fit the Rasch model. It provides an analysis technique that is not affected by the sample of individuals taking a test and this improves the rigor of measurement. De Roos & Allen-Meares (1998: 95-96) describe the Rasch model as a normative model for constructing interval-level “unidimensionality” of data on a group of subjects for set of items they have completed. The placement of items on a line that indicates greater and lesser amounts of the variable being measured constitutes operationalization of the variable. The Rasch model defines the ideal delineation of items that would constitute an objective, interval- level measuring instrument.

3.6.1.1 Structure of Rasch Model

Rasch model is $\text{Log} \left(\frac{P_{nij}}{P_{ni(j-1)}} \right) = B_n - D_i - F_j$

P_{nij} - the probability that a person “n” encountering item “i” is observed in category “j”

B_n - the “ability” measure of person “n”

D_i - the “difficulty” measure of item “i”, the point where the highest and lowest categories of the item are equally probable

F_j - the “calibration” measure of category “j” relative to category “j-1”, the point where categories “j-1” and “j” are equally probable relative to the measure of the item.

The measures give an indication of how the items are endorsed by the respondents. It thus provides a hierarchy of endorsement or agreement of the items. Reeve and Fayers (2005) assert that for an acceptable instrument constructed in accordance to Rasch modeling, the measure should fall within the range “2 logits to -2 logits”. The fit statistics are used to evaluate or find out if there are any distortions in the data. Linacre (2008, 306) asserts the “Misfit”, meaning the reported estimates, though effectively linear, does provide a distorted picture of the data. He also states that a mean-square (MNSQ) infit statistic “substantially less than 1 indicate dependency in your data” and the mean square outfit statistic is “more sensitive to unexpected behavior by persons on items far from the person’s measure level.” (Linacre 2008: p221).

3.6.1.2 The person –item map

It is a representation of the transformed data generated by Winsteps. It simultaneously provides an estimate of the respondent's level of endorsement and the item's rank in the same metric. The items are written on the right of the vertical line and the persons on the left. The items are assigned the measure given in the table but for its location, some clustering is done to essentially fit the scale of the vertical axis (Linacre, 2008). M indicates the average level deviation and T, two standard deviations. The person-item map allows for direct comparison of respondents to items.

3.7 Coding and Data Cleaning

The questionnaire with 23 items was appropriate as it was designed to collect data from large, diverse and widely scattered groups of people. It is used in gathering objective, quantitative data as well as in securing the development of information of a qualitative nature. The data were collected from 1839 participants of 26 schools for 3 months from 2012 to 2013 and was analyzed using the Statistical Package for the Social Sciences (SPSS) version 17.0.

3.8 Interview data

The interview component of this study aimed at articulating the general views respondents hold about the questionnaire. The aim centered on: the nature and content of the ROSME questionnaire; the aspects of the questionnaire they like or found interesting; the aspects of the questionnaire they disliked or found uninteresting; and the rationale behind their choices. Thus the general aim of adopting a qualitative-based approach was to elicit different responses on strengths, weaknesses, dislikes, likes and reasons attached to their experiences with the questionnaire.

Interviewing is a well-established method for the collection of data (Ary et al., 1979:174). The research interview has been defined as "a two-person conversation initiated by the interviewer for the specific purpose of obtaining research information, and focused by him on content specified by research objectives of systematic description, prediction and explanation" (Cohen & Manion, 1989:307).

As Takman cited Cohen and Manion (1989: 309), it gathers information, " by providing access to what is inside a person's head, [it]"makes it possible to measure what a person knows (knowledge or information), what a person likes or dislikes (value or preferences), and what a person thinks (attitudes and beliefs). This is the rationale for using the interview as a research technique.

The main types of qualitative research are:

3.8.1 In-depth Interviews

An interview is can be conducted one-on-one, and lasts between 30 and 60 minutes. The best method for in-depth interviewing is the probing of personal opinions, beliefs, and values. It is very rich in information, in-depth, very flexible. Probing is very useful at uncovering hidden issues. It is unstructured (or loosely structured), thus it is differentiated from a structured interview where all the same questions are asked to all respondents. Interviews can be time consuming and responses can be difficult to interpret. It requires skilled interviewers. There is no social pressure on respondents to conform and no group dynamics. It starts with general questions and rapport establishing questions, then the interview proceeds to more purposive questions.

In-depth interviews should be used in place of focus groups if the potential participants may not be included or comfortable talking openly in a group, or when you want to distinguish individual (as opposed to group) opinions about the program. They are often used to refine questions for future surveys of a particular group.

The primary advantage of in-depth interviews is to provide detailed information than what is available through other data collection methods, such as surveys. They also may provide a more relaxed atmosphere in which to collect information. People may feel more comfortable having a conversation with you as opposed to filling out a survey form. However, there are a few limitations and pitfalls, each is described below.

- 1. Prone to bias:** Because program or clinic staff might want to “prove” that a program is working, their interview responses might be biased. Responses from community members and program participants could also be biased due to their stake in the

program or for a number of other reasons. Every effort should be made to design a data collection effort, create instruments, and conduct interviews to allow for minimal bias.

2. **Can be time-intensive:** Interviews can be a time-intensive evaluation activity because of the time it takes to conduct interviews, transcribe and analyze the results. In planning your data collection, effort and care must be taken to include time for transcription and analysis of this detailed data.
3. **Interviewer must be appropriately trained in interviewing techniques:** To provide the most detailed and rich data from an interviewee, the interviewer must make participant comfortable and appear interested in what they say. They must also be sure to use effective interview techniques, such as avoiding yes/no and leading questions, using appropriate body language, and keeping their personal opinions in check.
4. **Not generalizable:** When in-depth interviews are conducted, generalizations about the results are usually not able to be made because small samples are chosen and random sampling methods are not used. In-depth interviews however, provide valuable information for programs, particularly when supplementing other methods of data collection. It should be noted that the general rule on sample size for interviews is that when the same stories, themes, issues, and topics are emerging from the interviewees, then a sufficient sample size has been reached.

In presenting results of in-depth interviews, you need to use care in presenting the data and use qualitative descriptors rather than try to “quantify” the information. Numbers and percentages sometimes convey the impression that results can be projected to a population, and this is not within the capabilities of this qualitative research procedure.

3.8.2 Advantages and disadvantages of an interview

Gay (1981:166) suggests the following advantages and disadvantages of an interview:

3.8.2.1 Advantages of an interview

- When properly used it can produce in-depth data not possible with a questionnaire.
- It is appropriate for asking questions that cannot be effectively structured in multiple choice format.

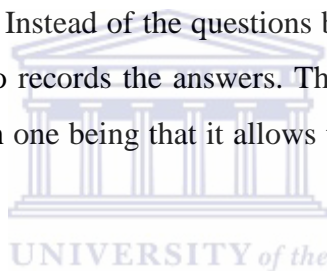
- It is flexible, so that the interviewer can adapt the situation to each subject.
- By establishing rapport and a trust relationship, the interviewer can obtain information that subjects would not give on a questionnaire.
- More accurate and honest response can be obtained since the interview can explain and clarify the questions.
- An interviewer can follow up on incomplete or unclear responses.

There are three types of interviews namely: structured, semi-structured and unstructured.

In the structured interview, pre specified questions are rigidly followed whilst in a semi-structured interview respondents are more free to express their views spontaneously. Unstructured interviews allow for free expression of opinions .

3.8.2.2 Structured interviews

It is built around a questionnaire. Instead of the questions being read by the respondent, they are asked by a surveyor who also records the answers. The surveys are carried out like this for a number of reasons, the main one being that it allows the researcher greater control over the sample of respondents.



The other main advantage of a structured interview schedule is that it provides an opportunity to obtain qualified answers. This is done in two ways – by proving and prompting. Proving is when the interviewer asks the respondent to explain an answer in a little more depth. Prompting on the other hand, is an attempt to ensure that the respondent has considered all possibilities when replying to the question.

3.8.2.3 Semi- structured interviews

It provides much more scope for the discussion and recording of respondents' opinions and views. The interview schedule still needs to be carefully designed but it will consist of some fairly specific questions, each of which may be proves or prompted, and a number which are completely open ended. The latter questions (prompt) mainly serve as a check list for the interviewer to ensure that the question is asked, the different facets are explored and that all the possible answers are covered. Semi-structured interviews are used to collect discursive information; qualitative as opposed to quantitative, to use the jargon which usually contains a

high degree of opinion or the expression of attitudes. It is a technique that could be used to explore such things as the type of service that people want, or the nature of problems experienced by managers. The interviews require a degree of structure but should, none the less, be fairly free-ranging.

3.8.2.4 Unstructured interviews

In unstructured interview, more effort needs to be put into ensuring that the interviewer stays fairly close to the point and is not drawn into interesting but irrelevant side-issues; that they record the information in an objective and consistent manner; and that they cover all aspects of the problem. This obviously presents much less of a problem if the interviews were conducted by one person who can usually be relied upon to maintain a fair degree of consistency. Where a number of interviewers are used the schedule should contain clear and precise instructions and there should be a period of training to help everyone at least begin in the same way.

3.8.2.5 Interviews in this study

The study applied a semi-structured interview technique. The questions were so designed that they seek information on the part of interviewer and supply information on the part of the interviewee. This is a reason for selecting the semi-structured interview.

In view of the fact that second part of the present study was qualitative in nature, the most appropriate form of an interview was that inviting open-ended responses. In open-ended questions, respondents are expected to provide answers in their own words. The type of question that one selects is dependent upon the nature of the problem that is being investigated (Bester and Oliver, 1992: 35). The interview revealed respondents thoughts, provide answers that fall within the parameters of their paradigms and, if requested to do so, provide reasons for their responses. The rationale behind choosing a semi-structured interview as an instrument for data collection was that since researcher asked more questions when a interviewee wanted to say more or researcher wanted to probe more in an interview with some of the learners, a semi-structured interview would give the researcher more control over the situation.

3.8.2.6 Sampling for the interview stage

Sampling is the process of selecting a number of individuals for a study in such a way that the individuals represent a larger group from which they were selected (Gay, 1981:85). Of the various types of sampling method, I chose purposive sampling. This is where the researcher handpicks the cases to be included in his or her sample on the basis of his/her judgment of their typicality. In this way, he or she builds up a sample that is satisfactory to his or her specific needs (Cohen & Manion, 1989:103). I have focused on the metropolitan, city and country-side regions in this study.

Because I am familiar with the staff members and have a close relationship with the mathematics departments of these schools, this helped me to communicate better with the interviewees. Sampling from the metropolitan, city and country-side regions would ensure that I obtained learners' opinions from all areas covered in this study.

In order to have sufficient information about the Korean grades 8 to 10 learners' contextual preference of learning mathematics, I interviewed 25 learners in total from grades 8 to 10 (13 females and 12 males). They were all willing to be interviewed. All respondents were afforded anonymity. Their interview data are presented in accordance with their request for confidentiality.

3.8.2.7 Contacting the interviewees

I planned to meet the educators who taught grades 8 to 10 mathematics in the selected three regions. As soon as I arrived in Korea, a visit to the selected schools was necessary to improve my informal interaction with the educators. This helped create a strong rapport with the respondents in order for them to respond confidently during the interview. After a while, I submitted the copy of the cooperative letter to the school educators.

Educators decided on a comfortable location for the interviews. I had a small meeting before the interview with the grades 8 to 10 mathematics teachers of each selected schools. This helped me to introduce myself and to:

- explain the aim of the research,
- explain the aim of the interview, and to indicate that the opinion of each respondent would be of great help,
- arrange an interview time with each interviewee, as we agreed that there will be flexibility on the scheduled time of the interview.

Some of the interviewees asked me for the interview questions before hand. They wanted to discuss with one another the responses of the questions. However, I explained that the questions are almost open ended, and every respondent should be confident of his/her own opinion about the interview questions. We have agreed to have a code for the name of each respondent. This helped the respondent to have confidence and to furnish better information for the research.

3.8.2.8 Conducting the interview

Each conversation with a respondent was recorded on audio tape. The learners were made aware of the fact that a recorder was being used, but that the principal and educators would not be listening to the recordings. I explained to learners that the researcher would be the only person listening to and analyzing the conversations. The interviews were conducted on an individual basis at school in an empty classroom during school hours. I had considered doing the interviews at home after school, but concerned that it would have a negative effect on the interviews from the learners' part. Learners may feel strange being interviewed at home as it was essential that they were relaxed and as comfortable as possible. To summarise, once the interview sessions were scheduled, the following procedures were implemented:

- Most of the interviews were conducted at the scheduled sessions.
- Both the respondents and researcher had interview cards of all questions and from the interview cards the learner selected most preferred, least preferred and middle preferred cards per category of question. The cards made use of picture depicting the categories (Appendix III).
- Researcher had indicated to the respondent the intent of capturing the respondents' answer through a mini-recorder and required the cooperation of the respondents in this regard.

- The interview was conducted in Korean language.
- Researcher asked the questions aloud.
- The respondent answered verbally.
- The duration of each interview was approximately 15-30 minutes.
- At the end of the interview, the researcher thanked each respondent for his or her willingness to participate in the research.

3.9 Method of data analysis and data presentation

3.9.1 Method of analysis of the data

Based on the reported data (Appendix IV contains the transcribed interviews), certain themes were developed. The themes are key points to be discussed, which researcher considered as some key factors about Korean grades 8 to 10 learners and their preferred contexts in dealing with mathematics. Hence, the following section focuses on the data presentation, and an analysis of the presented data in relation to the literature described in chapter two.

3.9.2.1 Levels of Analysis

Coded analysis: Coding involves identifying key elements of interest in the protocols and defining them in such a way that their presence or absence may be noted by raters. Elements may be defined grossly as the use of certain problem-solving strategies, or more finely as the presence of key words, phrases and equations.

Descriptive analysis: With this method the researcher is interested in providing a clear re-statement of what respondents said and did during the interview. An attempt is made to describe the data as they are, making no inference about underlying structures that may account for the data. The focus is on the surface of subjects' verbalizations, on the meaning they are explicitly trying to communicate.

Interpretative analysis: In interpretative analysis, inferences are made about the deep structures of respondents' reasoning processes. The researcher uses what the respondent says and does to make statements about processes and the knowledge structure (both explicit and tacit) they use in solving problems.

What must be noted is that a single interview is not just limited to one of the three types of analysis and then analyzed in only one of the types available. An interview could very easily proceed through all three types of interview starting as a thinking-aloud interview and then progress until it can be classified as a tutorial interview. The reason for an interviewer proceeding like this could be varied. Similarly, he or she may start off analysis using the coded analysis method, but may progress to the interpretative method, or could end up with a combination of all three. This is entirely a researchers' choice. Researcher may change methods as seen fit to enable the interview progress as smoothly as possible.

3.9.2.2 Qualitative data analysis procedure

The qualitative data analysis followed an interpretive approach. A practical guidance of grounded theory that sought to distinguish the processes that explain what was happening in a social setting (Strauss & Corbin, 1990, 1994) was followed. The data were analyzed by the constant comparative method (Merriam, 1998; Miles & Huberman, 1994; Strauss & Corbin, 1990, 1994). In the constant comparative method: The researcher begins with a particular incident from an interview, field-notes or document and compares it with another incident in the same data or in another set. These comparisons lead to tentative categories that are then compared to each other and to other instances (Merriam, 1998: 159).

The concepts, events, phenomena, incidents and ideas were identified from the data through open coding; manually first but later with the help of the Atlas/ti Hermeneutic Unit (HU) program. Open coding involved naming the phenomena or concepts to give meaning to the data. Substantive codes were derived from words that were identified as giving meaning to the data. Such codes are often called 'in vivo' codes. It is derived from the words that the participants used. Questions were continuously generated from the data and one concept was compared with another and each interview transcript was compared to another. As new ideas emerged further comparisons were made. Various formulations of categories were derived. For a detailed discussion of cross-sectional and categorical indexing; non-cross-section, all data organization; and the use of diagrams and charts were the three (3) non-mutually exclusive methods of sorting and organizing qualitative data (see Mason, 1996).

In other words, to consolidate, to reduce, and to interpret the qualitative data that were seen, read and heard from informants, "in some kind of integrated, complete, logical, succinct way" (Woods, 1986: 125) and to avoid a possible pitfall that "if you don't know what matters more everything matters" (Miles & Huberman, 1994:55), the method of data handling suggested by Merriam (1998) was adapted.

According to Merriam, the analysis of data process is a spiral process that involves five stages.

- Firstly, the interview transcripts, field-notes or documents were taken and the data were read at three levels: literally, interpretively (reading through or beyond data) and reflexively (Creswell, 1998; Mason, 1996).
- Secondly, the comments, notes, observations and queries are jotted down on the margin of the transcripts.
- Thirdly, the comments on the margin are re-read to form groups.
- Fourthly, groups of similar or like comments and notes are created.
- Finally, one returns to the first step to consider the next set of data. This process was repeated for other sets of data, while comparing notes and groups created. The groups formed were combined into categories.

The above descriptive procedure is mirrored in the spiral approach that Creswell (1998) describes. In the analysis conducted and to fasten the analysis process, each transcript was read and re-read several times while listening to the corresponding section of the audiotapes in order to check the accuracy of the transcription and the understanding of each participant's experience. The transcripts were then converted to text files and entered into an Atlas/ti Hermeneutic Unit (HU) editor for coding and analysis. The transcripts were read and re-read and statements, phenomena and events that appeared related were similarly coded.

Open coding was used to obtain initial categories of information about what the participants said, thus segmenting the information. The categories were construed as units of information made from events, occurrences, and instances (Strauss & Corbin, 1990). Next, similar coded events, statements that captured the meaning they conveyed as categories were grouped into

themes. Each category's dimensions and subcategories and their associated properties were identified. The categories were discussed with graduate colleagues and refined. The categories in each interview transcript were compared and contrasted with the others.

Similarities and differences were identified in the overall phenomena that best describes the experiences of the participants. After identifying the categories, their interrelationships were described.

3.10 Reliability and Validity in Quantitative Research

This section briefly considers reliability and validity as it relates to quantitative research. It covers issues of reliability, validity: content validity, statistical validity and external validity.

3.10.1 Reliability

According to Carmines and Zeller (1979:11) reliability refers to the "extent to which any measuring procedure yields the same results on repeated trials." Reliability is a measure of how consistent the same method of data generation produces the same results. In this study, the item reliability estimate for SA TMI were established using Cronbach alpha coefficient (α) as a measure of internal consistency because the items were scored on a Likert scale format.

3.10.2 Validity

Several authors have defined the concept of validity (Carmines & Zeller, 1979; 17, Mason, 1996). Carmines and Zeller (1979:17) defined validity as the "extent to which any measuring instrument measures what it is supposed to measure. Mason (1996) referred to it as "judgments about whether you are 'measuring', or explaining what you claim to be measuring or explaining ... [that requires the researcher's] conceptual and ontological clarity" (Mason, 1996: 146). Even though the definition of validity given by Carmen and Zeller (1979) as well as Mason (1996) differ semantically, they are similar in meaning. Both have the intent of fulfilling the researcher's goal. The Carmen and Zeller (1979) definition will be applied when considering the quantitative instruments. Meanwhile, the Mason (1996) definition will be useful for the interpretation of the qualitative data of this study.

3.10.3 Content validity or Face validity

Content validity is based on the adequacy with which the items in an instrument measure the attributes of the study (Nunnally, 1978). The content validity of the MPST instrument was ensured through constructive criticism from graduate student colleagues in the Graduate Studies in Science, Mathematics and Technology Education (GRASSMATE) programme. The items were revised and improved upon according to advice and suggestions that colleagues made. Further to this, a set of items were given to three (3) experienced mathematics and science educators, with expertise in questionnaire construction and a test developed to check on the suitability of the questions and the language used. The recommendations made by supervisors and colleagues were incorporated during the modification of SA TMI. The SA TMI questionnaire content validity was taken a priori because it has been widely used in research on students attitudes towards mathematics.

3.10.4 Statistical validity

According to Neuman (2000: 173), statistical validity requires that "the correct statistical procedure is chosen and its assumptions are fully met." Statistical validity refers to adhering to the major statistical assumptions about the mathematical properties of numbers used in the analysis. In this study, the statistical assumptions were met in choosing appropriate statistical tests and procedures for the various conditions of the method. This was guided by advice from qualified statisticians and statistics consultants.

3.10.5 Reliability and Validity in Qualitative Research

This section briefly considers reliability and validity as it relates to qualitative research. It covers issues of dependability, trustworthiness, credibility, transferability and confirmability. Thick description was used and allowed the researcher to ensure that the qualitative section of the study was rigorous and credible.

3.11 Ethical issues (Quantitative & Qualitative research)

In every research process ethical issues and considerations must be addressed and adhered to. Strydom (2001a) defined ethics as: a set of widely accepted moral principles that offer rules for, and behavioural expectations of, the most correct conduct towards experimental subjects

and respondents, employers, sponsors, other researchers, assistants and students (Strydom, 2001a: 75).

Several authors have discussed ethical issues and considerations in the literature (Bless & Higson-Smith, 2000; Cohen, Manion, Morrison, 2000; Mason, 1996; Strydom, 2001a). Nearly all these authors raised the same issues. According to Mason (1996), the commonly discussed ethical issues and considerations include: the rights to privacy and voluntary participation; anonymity and confidentiality; high quality practice and the building of capacity of all sectors of the community or responsibility to produce good quality research.

According to Strydom (2001a), while authors mostly discuss the same things on ethical issues, some authors discuss different classifications of ethical issues. Some authors broadly classify and discuss only few issues, while others do in-depth, detailed analysis about some issues. Discussions of ethical issues semantically vary and depend on the degree of emphasis that the different researchers adapt. For example, in comparing issues that Bless and Higson-Smith (2000) raise and those raised by Strydom (2001a), the key issues discussed relate to paying due attention to care against harm to experimental subjects and/or respondents; obtaining informed consent; taking care against deception of subjects and/or respondents; avoiding the violation of privacy or anonymity or confidentiality (self-determination); taking care about actions and competence of researcher; cooperation with contributors; release or publication of the findings; and debriefing of the subjects or respondents, the claim of the predominance of semantics came afore. Thus, one could say ethical principles form the researcher's constitutional toolbox or working document containing internalized 'laws' to guide, protect and inform the researcher and others in implementing the research agenda.

The research was also guided by the Children's Research Rights (Berk, 1991). These are stated as follows:

Protection from harm

Children have the right to be protected from physical or psychological harm. If in doubt of the harmful effect of research, investigators should seek the opinions of others. When harm

seems possible, investigators should find other means for obtaining the desired information, or abandon the research.

Informed consent

Informed consent of parents as well as guardians who act on a child's behalf should be obtained for any research involving children, preferably in writing. All research participants, including children have the right to be informed adequately about all aspects of the research that may affect their willingness to participate in a language appropriate to their level of understanding. Adults and children should be free to discontinue participation in the research at any time.

Privacy

Children have the right to concealment of their identity on all information collected in the course of research. They also have this right with respect to written reports, and in any formal discussions about the research.

Knowledge of results

Children have the right to be informed of the results of research in terms and explained in a language appropriate to their understanding.

Beneficial treatments

If experimental treatments believed to be beneficial are under investigation, children in control groups have the right to alternative beneficial treatments if they are available.

This study was conducted after the University of the Western Cape had approved the research proposal.

3.12 Summary

This chapter described the specific research questions for the study. Quantitative and qualitative research methods for the study were motivated for by the need for rich data. The combined quantitative and qualitative approach produced both numerical and non-numerical data. The sampling procedure involved accessing the preferred contexts for Korean grade 8-10 learners for learning mathematics for the year 2009 and surveying students in three different regions of Korea. After obtaining the results, then the appropriate selection of the interview sample from among learners was carried out.

The chapter described the development, administration of the instruments, the methodological issues of validity and reliability of quantitative research including credibility, transferability, dependability and confirmability in qualitative research. The chapter also highlighted the research ethics involving the protection of participants' rights. The evaluation of the pilot study suggested a number of modifications on the study instruments. A pilot study gave input into how the main study would be conducted. Data analyses techniques employed were described and justified.

The findings are presented in the following two chapters, firstly the findings of the survey study and secondly the interview findings.



CHAPTER 4: Quantitative Results and Discussions

4.0 Results from quantitative analysis

This chapter deals with the results of the data analyzed and obtained from the questionnaire. In order to ascertain learners' perspectives concerning the contexts to be used in mathematics, data were collected by using the ROSME II questionnaire as mentioned in chapter 3. This chapter presents the findings obtained by the use of the program and Winsteps 3.65.0 software (Linacre, 2008), as used for Rasch analysis.

4.1. The functionality of the instrument

In measurement it is customary to assess the functionality of an instrument to operationalize a latent trait. According to Julie, Holtman and Mbekwa (2011) functionality of measurement implies that an instrument is should be such that "...the contexts form a hierarchy and...the items comprising the questionnaire are unique (there are no redundant items)." The results presented below are related to these issues.

4.1.1 Measures

The results for the hierarchical ordering of the measures and their uni-dimensionality are presented in Table 4.1. In this study, using the ROSME II questionnaires, these measures fall within the range +0.88 to -0.58. Thus, Korean ROSME II is applicable to Korean learners of grades 8-10 as according to Reeve and Fayers (2005), the measures in Rasch analysis should fall within the range +2 logits to -2 logits.

Linacre (2008: 221) states that a mean-square (MNSQ) infit statistic "substantially less than 1 indicate[s] dependency on the data" and a mean square outfit statistic is "more sensitive to unexpected behaviour by persons on items far from the person's measure level." Infit and outfit mean square values in the range 0.5 - 1.5 are deemed to be "Productive of measurement" (Linacre, 2008: 221). Table 4.1 indicates that all the items fall within in this acceptable range and it can be accepted that the instrument is suitable for the purpose at hand.

Table 4.1: Measures and Mean Squares

ITEM	MEASURE	MODEL	INFIT	OUTFIT
		S.E.	MNSQ	MNSQ
C5	0.96	0.04	0.92	0.82
C8	0.39	0.03	0.84	0.78
C2	0.39	0.03	0.94	0.92
C14	0.31	0.03	0.9	0.83
C6	0.3	0.03	0.94	0.89
C11	0.29	0.03	0.86	0.84
C23	0.27	0.03	0.97	0.93
C20	0.15	0.03	0.86	0.83
C17	0.15	0.03	0.91	0.89
C7	0.04	0.03	0.93	0.92
C1	0.02	0.03	1.14	1.23
C19	0	0.03	0.85	0.81
C9	-0.08	0.03	0.91	0.9
C12	-0.09	0.03	1.09	1.09
C15	-0.11	0.03	1.13	1.15
C3	-0.12	0.03	1.2	1.28
C22	-0.17	0.03	0.99	1
C4	-0.25	0.03	1.09	1.1
C16	-0.25	0.03	1.07	1.05
C10	-0.41	0.03	1.17	1.16
C21	-0.53	0.03	1.11	1.08
C13	-0.61	0.03	1.18	1.22
C18	-0.64	0.03	1.11	1.11
Mean	0	0.03	1	0.99
SD	0.36	0	0.12	0.15

4.1.2 Person-Item Map

In Rasch analysis a person-item map is generated. It provides an estimate of the respondent's level of endorsement simultaneously as the item's rank in the metric. Figure 4.1 presents this person-item map for the cohort under discussion. The items are on the right-hand side of the vertical line and persons on the left. The items are assigned the measure given in Table 4.1. Some clustering has been done so that the items fit the scale on the vertical axis. The M in figure 4.4 indicates the average level of endorsement for the items, S stands for one standard deviation, and T refers to two standard deviations.

The person-item map allows for direct comparison of respondents to items. For example C21 has a measure of -0.53. There are at most 155 respondents (the left-hand side of the vertical axes with “.” indicating at most 11 and “#” 12) with the same measure. These respondents have a 50% chance of endorsing item C13 and C18 and a less than 50% chance of endorsing the items (C5, C11, C14, C2, C23, C6, C8, C17, C20, C1, C19, C7, C9, C12, C15, C22, C3, C4, C10, C16) with a measure higher than that of C21.

Inspecting the upper end of the map indicates that a maximum of 155 respondents have a 50% or more chance of endorsing item C5. This cements the position of C5 as the lowest-preferred context for this cohort of pupils. A similar cementing comes forth from the inspection of the lower end of the map. There are at most 662 pupils who have a less than 50% chance of endorsing items C13 and C18.

The person-item map also indicates that there are gaps between C5 and the group of items C11, C14, C2, C23, C6 and C8 in the spread of items, as shown in Figure 4.4. This indicates a “poorly defined or tested regions of the variable” (Linacre 2008: 206). Also observable are items sharing the same location such as C17; managing personal and business financial affairs and C20, the spread and decline of disasters. This normally indicates redundancy of items. However, as is clear from the items, they are not conceptually linked and thus are more indicative of a nearness of the measures and their graphic representation on the map.

A further characteristic of a measurement scale is that the items should not be biased towards or against subgroups comprising the sample. In Rasch analysis, differential item functioning (DIF) analysis allows assessing whether such biases exist. For the sample in this study DIF analysis was done to assess whether there are biases along gender, grade or location lines. The criterion suggested for testing item bias is that the differences between the item measures must not exceed 0.5 (Scheuneman and Subhiyah, 1998). Figures 4.1 to 4.3 below indicates that there were no item biases along the three dimensions.

Figure 4.1

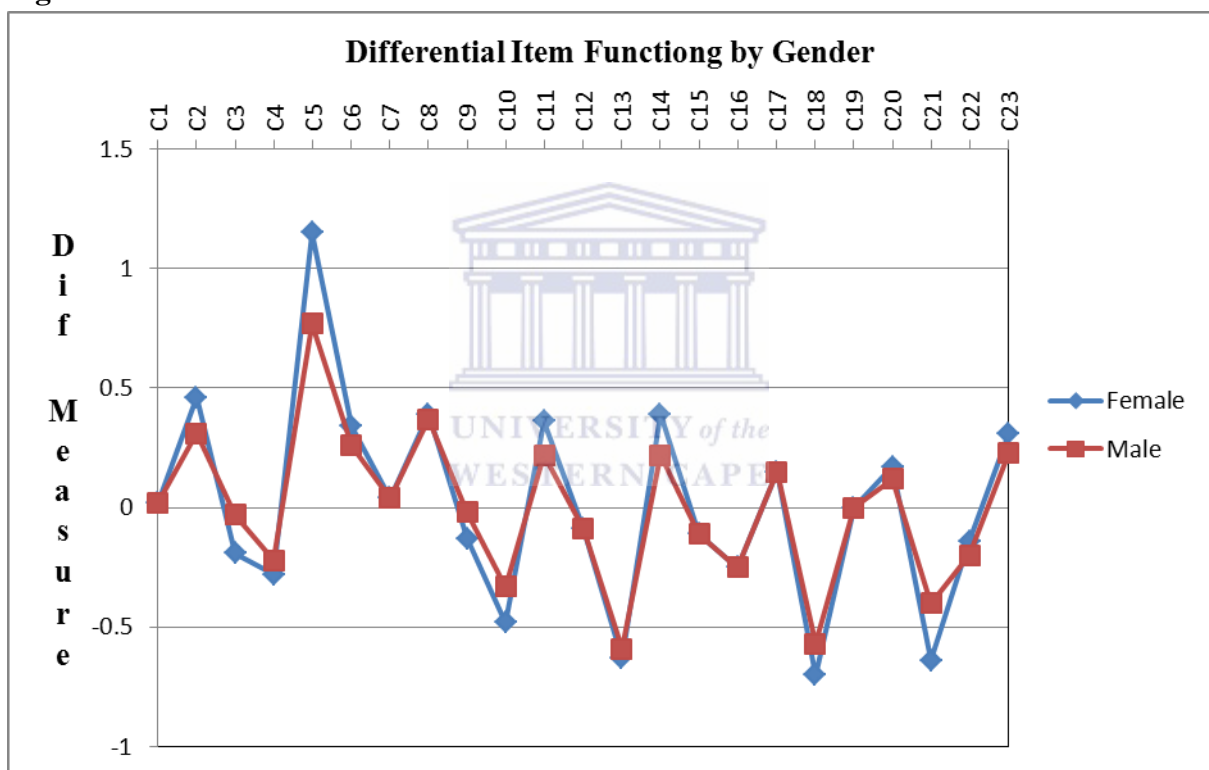


Figure 4.2

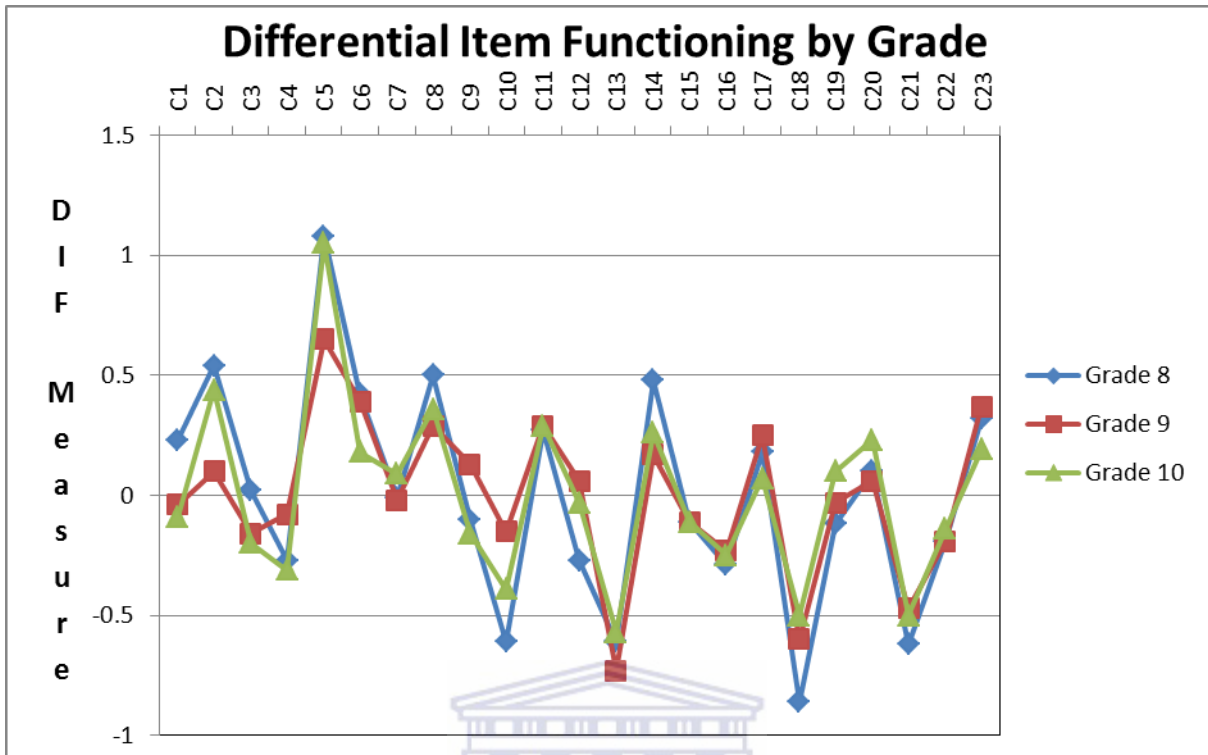
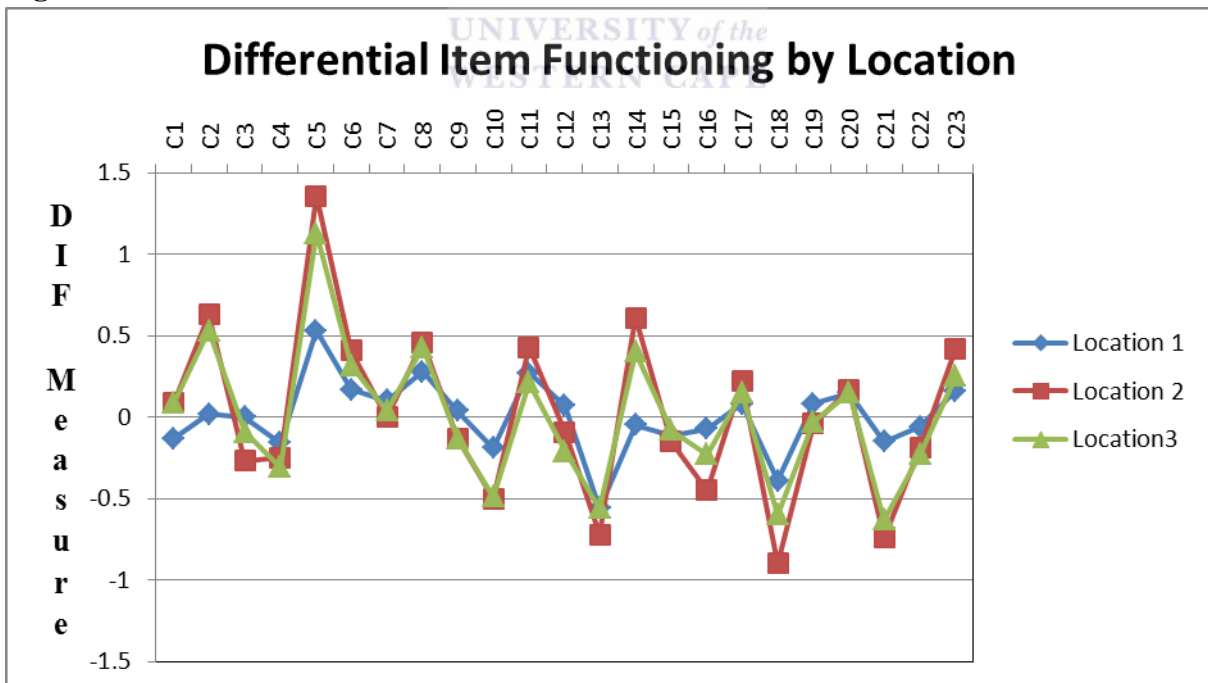


Figure 4.3

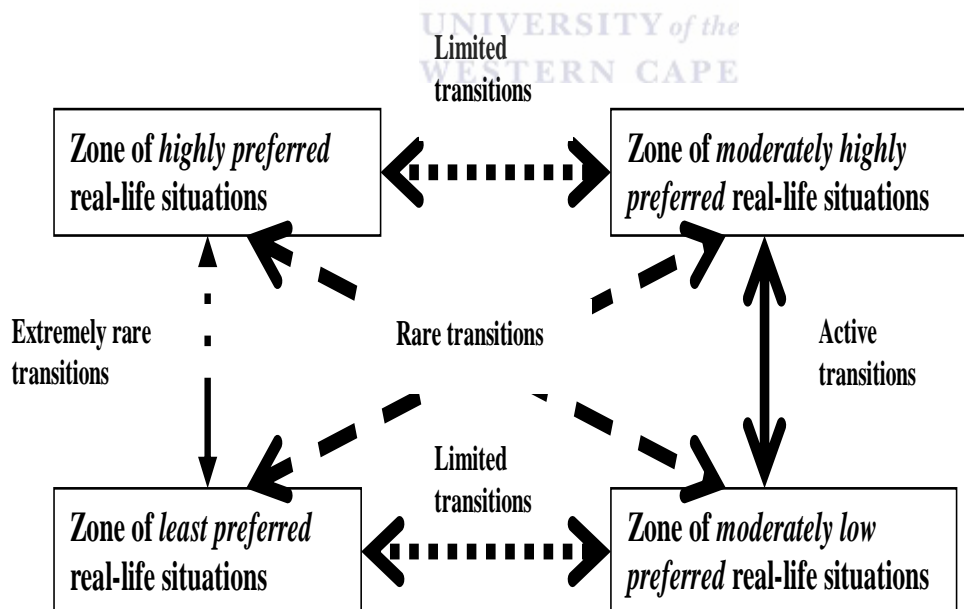


4.2 Hierarchical ordering of items and discussions of the orderings of real-life situations

From the analysis above it is concluded that the instrument to ascertain students' context preferences for use in mathematics is thus well within the range of acceptable values, and thus is acceptable as a scale constructed according to Rasch modelling. The hierarchical order of the items is thus as given in Table 4.1.

In order to obtain the preferences of Korean grades 8-10 learners, we draw on Julie, Holtman and Mbekwa's (2011) postulated model for learner preferences of contextual situations that could be used in mathematics. According to this model, preferences for real-life situations that could be used in mathematics can be classified into four zones of preference. These zones are presented in Figure 1 and centre around the standard deviations of the measures as indicated. Julie (2012) further propounds that one can expect some transitions between the zones and their nature is also indicated in the Figure 4.5.

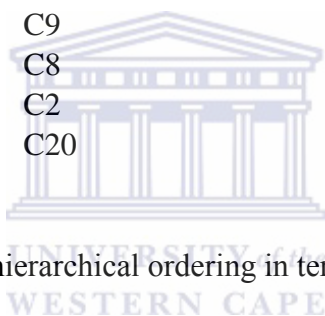
Figure 4.5: Zones of preference for real-life situations (From Julie, 2012)



In terms of these zones the Korean learners' preferences for contextual situations to be dealt with school are as presented in Table 4.2 below.

Table 4.2: Korean learners' preference for contextual situations according to zones of preference

High Preference	Moderately High	Moderately low	Low
C18	C16	C19	C5
C13	C4	C1	
	C22	C7	
	C3	C17	
	C15	C23	
	C12	C11	
	C10	C6	
	C21	C14	
		C9	
		C8	
		C2	
		C20	



What follows below are now the hierarchical ordering in terms of “zones”.

In Figure 4.1, the following observations are evident. The learners from Korea of grades 8-10 all expressed a high interest in two items: C18 (recreation/sport) and C13 (all kinds of pop music). They also expressed a low interest in the item C5 (agricultural matters). Moderate high endorsement is accorded to 8 items: C16 (electronic messages), C4 (secret codes), C22 (crime fighting/warfare), C3 (designer clothes), C15 (dancing), C12 (physical universe), C21 (planning a journey) and C10 (computer games/storing CD's, I-pods). The items C19 (emergency responses), C1 (lotteries/gambling), C7 (health matters), C17 (personal/business finances), C20 (epidemics/AIDS), C23 (construction/engineering), C11 (environmental issues), C6 (government financial matters), C14 (politics), C8 (community matters), C2 (traditional games) and C9 (production of a job) received moderate low endorsement by Korean learners of grades 8-10.

4.2.1 “Zone of highest preference” real life situations in grades 8-10 Korean learners.

Table 4.3 Zone of highest preference

C18	recreation, physical exercise, sport activities and competitions
C13	all kinds of pop music is

a. C18 (recreation, physical exercise, sport activities and competition) is the highest preferred context for mathematical learning. The word ‘recreation’ is frequently used interchangeably with play and leisure as if they are the same thing. Scholars, however, distinguish between these three concepts. According to Pigram (1983:3), cited in Veal (2004:8), recreation is considered to be an activity voluntarily undertaken, primarily for pleasure and satisfaction during leisure time. Regarding leisure, Murphy (1974: 72, 109, 153) defined it as “that portion of time which remains when time for work and the basic requirements for existence have been satisfied. Leisure can be viewed as non-work behavior in which people engage during free time. Leisure is that state or condition of being free from the urgent demands of lower level needs (cited from Veal 2004:5, 8).

In order to understand recreation, we will study the classifications of behaviours for recreational activities proposed by Murphy (1975). They include socializing behaviour, competitive behaviour, associative behaviour, risk-taking behaviour, exploratory behaviour, vicarious behaviour, sensory behaviour, physical behaviour, testing behaviour, creative behaviour, appreciative behaviour, variety-seeking behaviour, anticipatory and re-collective behaviour. Table 4.4 shows the distinctions between these types of behaviours.

Table 4.4. Murphy’s classification of behaviour

Classification	Contents	Kinds of activity
Socializing behaviours	Activities in this category address the human need for social interaction.	Dancing, dating, meeting friends, attending parties, singing.
Competitive behaviours	Activities in which individuals strive against others at a task, race or contest. Strategy and skill are required.	Computer game, card games, shuttle relay, draught, chess, snooker, badminton, handball, volleyball, basketball and squash racquet.

Associating Behaviours	Activities in which individuals sharing common interests come together	Bird watching, stamp-collecting,
Exploratory Behaviours	The individual tries to acquire fresh experiences by searching for something new.	Visiting caves, mountaintops, diving deep waters, travel, fishing, camping, studying insects.
Risk-taking Behaviours	Hazardous activities that may result in bodily injury or death.	Parachuting, jumping out from aircraft, car racing, mountaineering, and motorcycle racing
Vicarious Behaviours	Watching others who are actively engaged, instead of participating.	Watching television, listen to music or radio, watching sports, reading a novel, movie.
Sensory Behaviours	Activities caused by sensory organs. It refers to wild, uncontrolled behaviours undertaken in a quest for pleasure.	Sexual and visual activities that stimulate ecstasy, use of alcoholic beverages and drug. They are negative because these unwholesome activities can lead to drug addiction, alcoholism, rape and other forms of licentiousness and criminal behaviour.
Physical Behaviours	Physical activities undertaken for enjoyment, and not for competitiveness.	Swimming, dancing, aerobic dance, and working out in the weight room, running. Habitual participation in these activities improves physique and physical fitness.
Testing behaviours	Activities in which individuals train to pursue perfection	Shooting, climbing, puzzle.
Creative behaviours	activities, using tools, related with creativity	Arts, writing, taking photos, playing musical instruments.
Appreciative behaviours	Participatory and creative activities in which participants like their work to be enjoyed by others.	Painting, making sculpture, writing, performing.
Variety-seeking behaviours	Activities which someone experience to escape from the boredom of daily life	Community service, part-time job, shopping, urban-people going to mountain.
Anticipatory and re-collective behaviours	Activities of preparing for recreation, and processing the after-effects of recreation	

Murphy's classification of human behaviours includes nearly all types of daily activities. According to a study, the frequent recreational activities of Korean youth are in Table 4.5 (Cho, 2008).

Table 4.5. Recreational activities of Korean youth

Activities	Week			Weekend		
	Male (%)	Female (%)	Average (%)	Male (%)	Female (%)	Average (%)
TV and Radio	30.3	46.0	38.2	17.4	36.1	26.8
PC game	43.3	10.2	26.8	47.0	9.9	28.5
Movies and Exhibitions	1.2	0.7	2.0	4.3	5.4	4.9
Reading Comics and Books	5.5	5.9	5.7	4.9	5.6	5.3
Internet activities	3.3	12.5	7.9	3.3	9.5	6.5
Singing (Karaoke)	0.6	1.4	1.0	2.0	3.9	3.0
Listening to Music	4.3	8.1	6.2	2.1	4.2	3.1
Internet Club	0.4	2.4	1.4	0.3	2.4	1.3
Alcohol and Smoking	0.6	0.3	0.5	0.8	1.1	0.9
Sleeping	1.4	2.1	1.7	3.1	7.0	5.0
Conversation (SMS, Cell)	0.9	4.9	2.9	0.9	4.2	2.5
Community Service and Religious activity	0.0	0.2	0.1	0.3	4.2	3.0
Study	0.3	0.4	0.3	0.3	0.1	0.2
Sports	5.5	1.1	3.3	7.4	0.7	4.0
painting and playing musical instrument	0.6	2.1	1.3	2.2	3.2	2.7
Resting	1.6	1.5	1.5	1.7	2.2	1.9
Others	0.2	0.2	0.2	0.4	0.4	0.4

Table 4.5 consists of seventeen activities. Vicarious behaviours consist of five activities including watching TV and listening to radio (38.2%), movies and exhibitions (2.0%), Competitive behaviour includes PC gaming (26.8%). Sensory behaviour includes drinking alcohol and smoking (0.5%). Socializing behaviour includes singing (Karaoke) (1.0%), conversation (SMS, Cell) (2.9%). Creative behaviour includes painting and playing musical instruments (1.3%). Variety-seeking behaviour and associating behaviour includes community service and religious activity (0.1%), internet club (1.4%).

The time youths have for recreational activities during the week in the six school days system are 2.707 hours and 7.512 hours respectively during the weekend (Kim, 2005). Although there are various elements that affect the degree of satisfaction after partaking in recreational activities, the degree of satisfaction following recreational activities is 19% for grade 8 (Jang, 2004:137).

For the present study, however, learners selected recreation, physical exercise, sport activities and competition as their most preferred context for mathematical learning. When learners indicate that recreational activities is their highest preferred item for the present study, it might be that learners think of comparatively more active behaviours, such as physical behaviours, rather than vicarious behaviours focusing on passiveness. To them, recreational activity connotes active involvement, including competitive behaviours, and physical behaviours.

Many studies have proposed that activities of recreation enhance intellectual characteristics of youth's interpersonal and intrapersonal skills. There are three main benefits of recreation, sport and leisure, which have been called the functions of leisure as postulated by the French sociologist Joffre Dumazedier (1960, 1967). We will apply the three functions to our present study.

1. *Rest* is the first benefit. It relieves fatigue and makes good the physical or nervous deterioration and stress caused by usual school performance.
2. The second is *entertainment*. It mainly provides relief from the boredom of

monotonous and repetitive daily work. The monotonous and repetitive school work needs compensation. Entertainment meets the need for a periodical break away from customary duties by means of activities which are predominantly practical (certain forms of travel, games, sports) or based on fiction (participation in certain imaginary situations through films, novels, etc.). This break away may take the form of breaches of the legal and moral codes of society or, on the contrary, of more active participation in social life.

3. The third is *personal development*. It provides relief from the routine and stereotype behaviour consequent upon the automation of daily tasks. Recreational activity may allow time for the cultivation of physical or intellectual gifts for their own sake. It affords an opportunity of supplementing and improving the talents or knowledge acquired from and required from society to be constantly refreshed and carried further. It may favour more deliberate forms of social participation, such as clubs. It offers a setting and a new style of 'learning' favourable to the free blossoming of the personality through more active participation in cultural and social life, to the achievement of a style of living (Dumazedier 1960:526-527).


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In summary, by means of recreational activities, youths escape stress. Additionally, youths have exposure to different experiences, life styles, activities, identities social groups, and through recreation activities, they find positive self-images while increasing their school performance and engagement in education institutions. By participating in recreational activities, they can develop their mental and social health. Therefore recreational activities, specifically focusing on active behaviours are necessary to youths. Based on these benefits, learners have selected C18 'recreation, physical exercise, sport activities and competition' as the most preferred context for mathematical learning.'

- b. The second most preferred context is: C13 – all kinds of pop music. Pop music and youth are almost synonymous. Pop music is part of the normal identify of youth of any era. Together with pop music goes dance and youth preference for clubbing. This is frowned upon in Korean society as explained elsewhere.

4.2.2. “Zone of moderately high preference” real life situations preferred by grade 8-10 Korean learners.

Table 4.6 Zone of moderately highest preference

C16	sending and receiving of electronic messages such as SMS’s and e-mails
C4	secret codes such as pin numbers used for withdrawing money from an ATM
C22	crime fighting, warfare and military matters
C3	the latest designer clothes
C15	dancing such as rave, disco and hip-hop
C12	determining the origin and age of the universe
C10	making computer games and storing music and videos on CD’s and I-pods
C21	planning a journey

a. The first, in order of being nearest to the 2nd highest preferred item, is C21—planning a journey. A decade ago, travel was not popular amongst youth for various reasons. First being that there was an intense pressure on youth to focus on their studies. They did not see the need to go travel, and schools did not allow learners to be absent. During the two longer holidays, summer and winter vacations, students had to stay at school for extra school work. The second reason why travel was unpopular was financial constraints. However, the Education Department has since then decided that travel must be undertaken as part of the school curriculum. Learners now have the option to travel during school terms as the Korean lifestyle is more supportive of the travel.

Through the theme of journey and travel, learners can directly experience culture, the environment, history, industry, economy, science, and music which is not emphasised in the classroom. Journey and travel is thus becoming a popular subject for youths. According to Korean youth research (1993), the most favourite leisure activity is travel, amounting to 36.6%. In 2009, 10% of youths between 15-24 years have travelled overseas. Trips focusing on learning languages, specifically English have increased from 13.9% in 2007 to 26.0 % in 2009. During the first day of the lunar month (New Year), about 0.6 million Koreans plan to travel to foreign countries. This situation reflects the learners’ preference of learning

mathematics through traveling.

b. The second moderately high preference to learn mathematics is C10—making computer games and storing music and videos on CD's and I-pods. In September 1971, the “Galaxy Game” was installed at a student union at Stanford University. Based on “Spacewar”, this was the first coin-operated video game. Only one was built, using a DEC PDP-11 and vector display terminals. In 1972 it was expanded to be able to handle four to eight consoles. In the 1970s, video games were being used as a tool for entertainment and fun. Ever since in Korea, video and personal computer games have seen increasing development. The entertainment industry has seen game production increase exponentially in the following decades. In a world of technology and innovation, computer games are playing an important role. Today computer games are a part of Korean learners' life style. According to MCSTK research (2008), 96% of Korean youth have experienced computer games. The average time that 33% of youth spend daily playing computer games is between 1 and 2 hours.

For the development of a social impact game, a forum was formed with delegates from the Korean government, academia and gaming industry on the 9th of July 2008 to develop a strategy for further development. Since then, there has been many conferences and seminars. With the development of IT (information technology), computer games tend to fall into two categories: recreational (e-sports) and social impact games (education-based computer games).

The importance of computer games include the fact that computer games increase creativity with the use of social networks. The Korean society has many problems ranging from environmental problems, unification between South Korea and North Korea and Alzheimer's disease. Secondly, computer games open an avenue for healing and rehabilitation. If computer games are developed with technologies, such as vision, hearing, or biotechnology, they can be used to encourage patients to take control of their health and rehabilitation. Thirdly, computer games can be an aid for academic excellence. As discussed, interest in one's academic studies is the most influencing factor in achievement. Computer games offer fun ways of gaining academic knowledge, thereby increasing one's interest in achieving.

As IT resources and capabilities improved, e-sport also developed in the 1990s with the indirect encouragement of the Korean government, highlighting the government's recognition

of its importance. In December 1997, the first Korean Pro Gamers League was held, marking its remarkable increase in popularity. Nowadays, there is even a broadcasting TV station dedicated to e-sports and it has become an important sub-culture among many Korean learners.

Today e-sport in Korea is recognized as a new sector of industry more than just “playing games.” It related with economic growth as well as youth culture. Regarding economic growth, Korea’s game market was valued at USD 5.54 billion in 2007 (Ministry of Culture, Sport and Tourism 2008:31). It creates new jobs such as pro-gamers, pro-teams, coach, interpreter, judge, observer, etc. Regarding youth culture, e-sport becomes a part of youth culture. While movie, music and animation are parts of a passive culture to see and to hear, e-sport is a part of active culture to participate and to do. Today rapid changes in the society due to information technology increases uncertainty. When youth feel unstable in times of uncertainty, e-sport encourages the learning of regularity and irregularity in times of rapid change. E-sport trains people to learn rules in high speed so that the mind and body are coordinated.

c. The third moderately high preferred context for learning mathematics is C16, mathematics involved in sending and receiving of electronic message such as SMS’s and e-mails. Electronic items, such as the smart phone, I-Pad and samsung galaxy tab are popularly used by Korean learners in present time. Further to this, video calling technology is starting to be used in Korean society. According to a research by Choi, Oh, and Seo, (2010), 87.8% of learners between 16 and 19 years old use cell phones and the average time per day is about 59 minutes.

This topic is related to Information and Communication Technology (ICT) or delivery. ICT is an umbrella term that includes any communication devices or applications and encompasses: radio, television, cellular phones, computer networks’ hardware and software, satellite systems and so on, as well as the various services and applications associated with them, such as video conferencing and distance learning. ICTs are often spoken of in a particular context, such as ICTs in education, health care, or libraries.

Communication is a central aspect of all our lives. Today, our modes of communication are highly dependent on technologies such as the internet, wireless networks, phones and computers. These forms of communication are part of our daily lives and highlight some new directions in communications technology. South Korea has become a strong ICT country. Most families in Korea have access to an ADSL for high speed internet. DMB (Digital Multimedia Broadcasting) has also been introduced to the Korean society.

Information Technology (IT) is a broad subject concerned with technology and other aspects of managing and processing information, especially in large organizations. In particular, IT deals with the use of electronic computers and computer software to convert, store, protect, process, transmit and retrieve information. For this reason, computer professionals are often called IT specialists, and the division of a company or university that deals with software technology is likewise called the IT department. Other names for the latter are Information Services (IS), Management Information Services (MIS), or Managed Service Providers (MSP). IT is transforming all aspects of our daily lives including commerce, employment, manufacturing, education, health care, government, national security, communications, entertainment, science, engineering, etc.

d. The 4th moderately high preferred context for learning mathematics is C4, mathematics involved in secret codes such as pin numbers used for withdrawing money from an ATM. This topic is related to information law regarding privacy, security, technology, and intellectual property. Recently the South Korean government announced that all municipal public documents would be issued through internet and e-mail so that citizens everywhere could access them. Furthermore, advanced electronic items such as smart phone, tablet PCs like I-Pads, galaxy tab have brought about a revolutionary change in society. We are entering the smart city age where we communicate, do business, work, study and have medical treatments using modern electronic items.

Modern technology allows information to flow quickly and easily. Information is power. Information is a time-bound business. As discussed, information technology plays a very important role in every field of our daily life. But there is also a negative side of IT; it includes cyber-crimes such as hacking, it increases receipt of spam and unwanted advertisements, violation of the intellectual property, and defamation.

Information technology is being used more, and with it comes the danger of abuse of private information. Information which is released illegally is being used for spam mail or illegal telemarketing. Furthermore, this information can be used in more serious cyber crime and thus the cost of the damage is incalculable.

The Korean government has consequently passed strict information laws, which has led to a considerable rise in the business of information protection as well as a discussion in the Korean society with regard to the protection of private information and communication.

e. The fifth moderately high preferred context to learn mathematics is C22, crime fighting, warfare and military matters. Stories of private investigators fighting crime provoke excitement and interest and are often based on the concept of Sa-pil-gwi-jeong, which refers to the idea of, “every happening returns necessary to the just” and (Locard was the director of the very first crime laboratory in existence, located in Lyon, France). Locard’s exchange principle is named “every contact leaves trace”. Thus crime fighting TV drama program such as *Numb3rs*, *NCIS*, *CIS*, and *Sign* have been well-received in Korea. One of the characteristics of these dramas is that they are based on scientific investigation, including mathematics. Specifically, the drama *Numb3rs* begins each week with a reminder of the usefulness of mathematics and follows:

We all use maths every day; to predict weather, to tell time, to handle money. Maths is more than formulas or equations; it’s logic, it is rationality, it is using your mind to solve the biggest mysteries we know.

Mathematics provides useful information in fighting crime. Mathematics involves working out the time of crime, collection of the useful data, analysis of the evidence, the finding of the patterns of crime etc. Even today, mathematics is used for the advanced technology crimes, such as internet fraud, computer hacking, virus production, spamming and many more.

Mathematics is like a “bellicose art”. Throughout history, mathematics has been used in warfare and military matters. Mathematics has enhanced the efficiency of delivery and achieved new dreams of invincibility. During the Second World War, mathematicians worked with the military to produce the atomic bomb, the jet propulsion system for rockets, and the computer. Since then, a new phase of alliance has opened between mathematicians

and the military. Mathematical work has had the greatest influence on peace and war in the 20th century. New ways of warfare came from the mathematical idea:

“It would be better [...] to liken [war] to business competition, which is also a conflict of human interests and activities; and it is still more like State policy, which again, on its part, may be looked upon as a kind of business competition on a great scale.” (Clausewitz 1983:202)

Warfare and military matters are very sensitive in Korea. Ever since the separation from North Korea, there has always been war-like tension between the South and North. As recently as March 2010, North Korea shot torpedoes at a South Korean military ship. In November of the same year (2010), North Korea bombarded South Korea's Yun-Pyung island. Because of this tension between North and South, every Korean male youth must participate in military service and it is obligatory. Thus the Korean youths accept the importance of mathematics in military matters.

f. The sixth moderately high preference to learn mathematics is C3, the latest designer clothes. Traditionally, Korean youths did not have much choice in their choice of clothing on a daily basis because of obligatory school uniforms. In this context, clothing design was an adult-only business. With the recent IT development, learners using electronic items such as smart phones, I-Pod, I-Pad, Samsung's galaxy tab have easy access to entertainment such as music and drama. The celebrities here have become idols to the youths fashion-wise. This phenomenon could be understood as a form of catharsis; this is where learners are able to escape from the pressures of too much study.

Nowadays, learners' fashion is a part of the youth culture beyond being a form of catharsis. Fashion is one way for learners to express themselves. It has become part of the youth culture. Youth fashion is now starting to be recognized as a business field in its own right and has become one of the biggest businesses in fashion logistics in Korea. Furthermore, there are fashion design competitions in which youths can participate.

Today, fashion design relies on computer drawing. Thus, one cannot master the use of computer-based tools without a thorough understanding of the mathematical principles involved. The necessity of mathematics in fashion design can be seen in Sandy's statement:

“when somebody is designing and creating fashion to be worn on the body there’s a constant movement between 2D and 3D, which is what fashion designers are doing all the time. For example pattern cutting is really quite technical and quite mathematical: it is actually a form of engineering” (Thomas, 2009).

g. The seventh moderately high preferred context for learning mathematics is C15, dancing such as rave, disco and hip-hop. According to a recent study, the style which pupils prefer most during dance class is aerobics and hip-hop. The reason for youth-like dancing is to enjoy freedom from pressure. Dancing has become a tool to escape school stress involving entrance exam preparations and also from limited social activities. Hip-hops especially is a psychological expression of youth while they enjoy comparatively good material prosperity and culture than in previous period (Special Plan Team of Webjin, 2007).

However, there is a negative attitude prevalent in Korean thinking regarding some dances such as rave, jazz, hip-hop. There are two types of influence on this matter: Confucianism and the hope of a better life.

Confucianism is the backbone of Korean philosophy. According to this philosophy, dance was an activity associated with the lowest class in traditional Korean society. This viewpoint is in contrast to the Western viewpoint of dance. Due to the tradition of Confucianism, one of the characteristics of Korean culture is an exclusive heterosexual culture (Park Y-B 2005:25). Therefore, since the inclusion of dance, was practiced and developed in underground scenes, it was perceived to be a cause of social and family problems.

The philosophy of ‘a better life’ contributed to this. This type of thinking developed with the occurrence of three big events. Firstly, the Korean war came about after North Korea attacked the South during 1950-1953. During and after the war, most Koreans on both sides experienced poverty and starvation. To them, ‘a better life’ naturally became the main motto in daily life. Secondly, the Korean military culture played a role in forming this attitude in Korean society. The military culture was formed by three consecutive governments that ruled for a total of 28 years. It was during this period that civil defence training was introduced. Thirdly, the “Saemaul Undong” was a movement for a better life. Samaeul Undong, initiated by the first military government of 18 years, implanted a new labour ethics characterized by

hard work (Park, 1998). These three events influenced the Korean mindset greatly and negative attitudes were developed concerning leisure culture, including dance, music, arts, sports, tourism. Specifically, the Korean society has a very strong negative attitude against dance and adults may still exhibit this attitude. Dance might therefore carry a social stigma.

In this context, the focus of school curricula was on subjects such as Korean language, English and Mathematics which are called tool-subjects. Outdoor and physical educational subjects were ignored. Korean society has found itself unable to escape from the philosophy of the first priority of school education, that is, if every youth has a good school education, they can improve their IQ (Intelligence Quotient), SQ (Social Quotient), EQ (Emotional Quotient) and FQ (Financial Quotient). Today, however, the school system has lost its vitality because schools cannot respond to students' modern contexts.

Mathematics materials still do not (or rarely) contain topics about dance, including rave and hip-hop and students are still ignorant about this topic. Thus this context has led learners to choose C15 as their fifth moderately high preferred context for mathematic learning.

The culture of dance must be soundly developed in order to contribute to the physical development of a youth. Lower cultural dance includes hip-hop, disco, break-dance which are not practiced in school education. These kinds of dance help youth control resistance and aggressiveness. According to a study (Jun M-R, 2011), a group of students who had hip-hop dance instruction showed better results in positive happiness than groups of students who did other sports. The group who did hip-hop dance also showed lower levels of tiredness.

h. The 8th moderately high preferred context to learn mathematics is C12, mathematics determining the origin and age of the universe. Determining the origin and the age of the universe is a big question. The space industry is the latest industrial field which the Korean government is pursuing. The Korean government has established the Korean Aerospace Research Institute (KARI) through which several satellites have been launched into space. In order to increase interest in aerospace study, this company operates school tours twice a day to view the display centre that was installed in the company's buildings.

The Korean government also opened Naro Space Center on the 11th of June 2009. On the 25th of August 2009, the first spacecraft, KSLV (Korean Space Launch vehicle), was launched into space, though it failed to go into space, this event may have inspired youth.

Korea has also launched a project with NASA to study space with the aim of calculating the age of the universe, with the outcome that Galaxy Evolution Explorer (GALEX) was launched on 28 April 2003. GALEX is an orbiting space telescope that will observe galaxies in ultraviolet light across 10 billion years of cosmic history. Such observations will tell scientists how galaxies, the basic structures of our universe evolved and changed. Additionally, GALEX will probe the causes of star formation during a period when most of the stars and elements we see today had their origins. With its ultraviolet observations, GALEX will fill in one of the key pieces of this puzzle. The Korean government also contributed to a special observatory in Sutherland, South Africa in 2002. The transmission of photos from space was calculated using mathematical principles.

4.2.3. “Zone of moderately low preference” real life situations in grade 8-10 Korean learners

Table 4.7 Zone of moderately low preference

C19	responding to emergencies and disasters
C1	lotteries and gambling
C7	health matters such as the state of health of a person, the amount of medicine a sick person must take
C17	managing personal and business financial affairs
C20	the spread and decline of epidemics such as AIDS; tuberculosis and cholera
C23	construction and engineering
C11	environmental issues and climate change
C6	government financial matters, such as inflation and taxes
C14	national and international politics
C9	being productive with the doing of tasks in a job
C8	determining the level of development regarding employment, education and poverty of my community

C2	mathematics linked to Korean traditional games, such as “yut”
C20	the spread and decline of epidemics such as AIDS, tuberculosis and cholera

a. The first moderately low preference for learning mathematics is C9, being productive with the doing of tasks in a job. This item is related with efficiency and mathematical thinking. Modern society is task-oriented to achieve self-efficacy. By definition, efficiency refers to the use of resources so as to maximize the production of goods and services. In the 2006 PISA study (OECD, 2007: 53), Korean learners took 4th rank with mean scores of 547 points, and regarding self-efficacy, however, Korean learners took 48th position out of 57 countries. In the 2009 PISA study (2010:6), Korean learners took 2nd rank with mean scores of 546, regarding self-efficacy, however, Korean learners took 24th rank with 64.5 out of 30 OECD countries. The average score for self-efficacy of OECD countries is 72.1 which is higher than that of Korean learners.

Mathematical thinking is the mathematical mode of thought. It can be defined as applying mathematical techniques, concepts and processes, either explicitly or implicitly in the solution of problems (Khalid, 2006). Mathematical thinking promotes an understanding of the necessity of using knowledge and skills as well as learning how to learn by oneself and the attainment of the abilities required for independent learning. Accordingly, mathematical thinking is important for teaching and learning mathematics. Mathematical thinking is an important goal of schooling (Stacey, 2006).

Mathematical thinking can be divided into three categories (Katagiri, 2006), with the first category considered as the driving force behind the two later categories:

I. Mathematical Attitudes

II. Mathematical Thinking related to Mathematical Methods

III. Mathematical Thinking related to Mathematical Contents

Mathematical thinking related to mathematical methods was listed in detail by Katagiri (2006) as consisting of inductive thinking, analogical thinking, deductive thinking, integrative thinking, developmental thinking, abstract thinking, thinking that simplifies,

thinking that generalizes, thinking that specializes, thinking that symbolizes and thinking expressed with numbers, quantifiers and figures.

There are also four fundamental processes in mathematical thinking (Khalid, 2007):

- I. specializing – trying special cases, looking at examples
- II. generalizing – looking for patterns and relationships
- III. conjecturing – predicting relationships and results
- IV. convincing – finding and communicating reasons why something is true

b. The second moderately low preferred context for mathematical education is C19: responding to emergencies and disasters. Disasters today are becoming worse and more frequent. Disasters can be divided into two types: natural and unnatural. Korea has natural disasters such as flooding, heavy snowfall, wildfires, epidemics, and so on. Unnatural disasters include accidents such as train collisions, subway construction collapses, apartment destructions, plane crash. Recently, cyber-disasters have also occurred in Korea.

The most serious unnatural disaster in Korea was the war between the South and the North in 1950-1953. Since the truce in 1953, there has been constant military tension between the South and the North. Since the inception of the civil defence training in 1975, monthly emergency escape routines are practiced nationwide up to today.

In this context, Korean learners used to experience one of two reactions to emergency and disaster: extreme terror or ignorance about disaster (Lee, 2010: 128) but since Korean learners have rarely experienced disasters caused by terror, they may think that disasters must be dealt by government, and so do not have enough information about emergency and disaster. Therefore learners have taken this as a moderately low level concern..

A major disaster involving earthquakes, tsunamis, and nuclear disaster crises with added dangers of radioactivity and radioactive material leakage occurred in Japan on the 11th of March 2011 raising awareness about disasters, the necessity of training for it in education and mathematical education. This has led learners to rethink their attitudes to disaster.

c. The third moderately low preferred context for mathematical learning is C1, lotteries and gambling. The history of the lottery in Korea began with Japanese colonization. With the establishment of the Korean government in 1948, the government initiated lotteries in order to fund Korean Olympic athletes' attending the London Olympic games. Lotteries these days are highly popular in Korea, though not without its share of controversies. There are pros and cons that have been debated concerning this issue. On one hand, lotteries have positive benefits. They are a tool to gather public funds. About 40% of income generated from lotto ticket sales is used for the building of houses, infrastructure, etc. They therefore have a beneficial aspect to the whole of society.

On the other hand, lotteries have negative aspects. People who buy lotto tickets often have dreams of Daebak. The term "Daebak" originated from the lottery business and is also used in the context of the real estate business in Korea. Daebak is a metaphor connoting a big fortune or a big success which has been gained without having had to work for it. Unfortunately, not all who buy a lotto ticket can get a Daebak, and as a result, most buyers are affected by psychological side effects or sequelae. So the Korean government has been critiqued as provoking gambling psychology. Secondly, lotto is seen as a second form of tax to the lower socio-economic class. To them, the lotto contains the hope of being able to change their life. With this hope, individuals are more likely to buy lotto tickets and this is thus known as a type of taxation. Finally, lotto disrupts daily lives and work routines because of its unpredictability of good fortune.

The government also introduced another type of lotto aimed specifically at youth. According to law, youth under the age of 19 years cannot buy lotto tickets. The government thus initiated a "junior lotto" for minors. The purpose of the junior lotto is to activate a cash slip system among juniors. Adults can use cash slips for tax reduction but youths cannot use theirs for tax reduction.

Gambling itself has been seen in a positive and negative light. Firstly, gambling contributes to an increase in income. For instance, casinos can be a major source of income as seen in America which has the most casinos in the world. Secondly, the gambling business increases employment. Gambling is a tertiary industry which employs three times more people than other tourism businesses. Thirdly, the economic ripple effect is very high. Currency

commodity exchange is very high; the rate is as high as 93.7%, while the number is only 39% through exports of semiconductor and 60% through TV exports. Recently, Kangwon Land casino shares started trading on the KOSDAQ (Korean Securities Dealers Automated Quotations) which is a trading board of Korea Exchange (KRX) established in 1996. This is an indication of the vitality of the stock market. Fourthly, it contributes to local community development. Building leisure facilities and the expenditure of tourists in the community contributes to the development of local businesses. Finally, it opens up leisure opportunities to the society.

Gambling also has negative consequences. Gambling can lead to addiction which can destroy individuals as well as their society. This in turn can be a cause of crime in society. Scholars in psychiatry define “addiction” as pathological and see it as an impulse control disorder. Secondly, gambling can lead to a gambling mentality namely, dreams of winning a Daebak without working for it. Thirdly, gambling is a cause of crime. The large amounts of money involved in gambling are often connected with organized crime syndicates. Because of addictions, individuals have also been known to be drawn into the depths of the crime such as murder and drugs in order to gain money to use for gambling. Fourthly, gambling destroys family-life. Individuals who lose all their money in gambling often do not return home, rather they end up homeless on the street. The prime purpose of gambling is to bring in foreign currency but it fails to do so. Local people are drawn into gambling, thus destroying the family setting. Finally, gambling produces social incongruities and inequalities. In the Korean society, there are many poor workers who do intensive manual labour. When these workers hear and see people fortunate enough to get Daebak, they develop unhelpful thoughts about labour which provokes social incongruities.

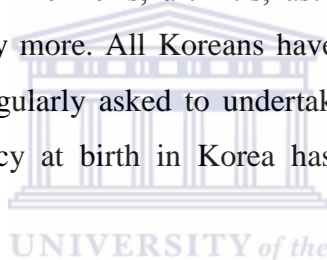
In summary, we have discussed the positive and negative aspects of the lotto, as well as gambling. It seems that the pros and cons of lotto balance each other out. It cannot be denied, however, that lotto and gambling have bad reputations in the Korean society. Because of these strong negative associations mixed with potential to win large money by investing a small initial amount, learners might select this topic as only a moderately low preferred context for mathematical education.

d. The fourth moderately low preferred context in which to learn mathematics is C7, health matters such as the state of health of a person, the amount of medicine a sick person must take.

After the country's liberation from Japanese colonization in 1945 and its the subsequent Korean War from 1950 to 1953, the Korean society focussed mainly on poverty eradication with the development of agricultural businesses through the Saemaul Undong initiative. At the same time, the secondary industry makes products that fall into the categories of telecommunications, manufacturing etc.

During this time, science and technology were also in developmental stages. Through these periods, development of welfare and health status was also emphasized. In reality, they were largely ignored in a sense due to the effort spent on economic growth (Kim, 2006).

Recently, the terms, well-being and social welfare, which are closely related to health and quality of life, have become popular. Koreans are very aware of modern diseases, such as diabetes, high blood pressure, Alzheimer's, arthritis, asthma, eczema, fibromyalgia, gout, migraine, osteoporosis, and many more. All Koreans have medical insurance sponsored by the government, and are thus regularly asked to undertake medical examinations for their health status. The life expectancy at birth in Korea has recently been reported to have increased to 80 years old.



Mathematics is a useful tool to express health status in terms of numbers. Mathematics is also related with the budget of health industry and with the taking of medicine. Learners must understand how mathematics is used for wellness and healthy eating in everyday life. However, learners are unaware of this topic because, learners think these topics are the concerns of adults, leading them to choose this topic as the tenth least preferred context for learning mathematics.

e. The fifth moderately low preferred context for learning mathematics is C17, managing personal and business financial affairs. While C6 is related to national financial affairs, C17 is related to individual financial planning. These two topics are related with financial literacy and financial mathematics or mathematical finance in one way or the other. Just as seen in the previous topics, financial mathematics or national financial affairs are not popular topics for Korean learners, so it stands to reason that financial planning is not a topic

of interest either. There are various reasons why learners are not interested in this topic (Kim & Choi, 2003).

1. Firstly, Korean education system is a system oriented on admission from lower grades to higher grades, for instance from middle to high school or from high school to tertiary school. The subject economics is included in the subject “social studies” which has three components including geography, history and general social studies. The general social studies comprise four topics including politics, economics, cultural studies, law. In this context, according to a study, the learner’s exposure to economics is very low, with only 38% of their time being spent on this subject. Furthermore, with financial planning being a minor part of economics, learners have little time devoted to this field.
2. Secondly, learners do not want to take the subject economics for the admission exam as this subject is allocated with little learning time in school, yet has a lot of content. Therefore, learners would prefer to select easier subjects in order to get high marks in the exam.
3. Thirdly, school learners must learn the content of the subjects focused on the theory and concept of economics as based on the curriculum. Often times, the curriculum is not relevant to real life nor is it strongly related to the subject ‘economics’ at university. Thus this does not create interest among learners about financial business affairs in the real life.

With these reasons in mind, learners choice to select the financial planning as their fourth moderately low preferred subject for mathematical learning is understandable.

f. The sixth moderately low preferred context for mathematic learning is C20, the spread and decline of epidemics such as AIDS, tuberculosis and cholera. Korea has a public health care insurance system called the National Health Insurance (NHI). The NHI is the only national insurance system administered by the government of the Republic of Korea, and covers over 97% of the Korean population. Monthly premiums are thus relatively cheaper than in other countries. Accordingly, Koreans want to have high quality medical treatment,

the health care level of Korea is of a very high standard, with an important focus on well-being or social welfare.

In this context, learners do not care much about sickness and illness or about epidemic diseases such as AIDS, tuberculosis and cholera. Furthermore, learners are not exposed to many awareness programmes of the prevalence of HIV/AIDS. These topics seem to carry negative connotations amongst learners. Thus learners may select this topic as their fifth moderately low preferred context for mathematic learning. But with mathematics, experts can predict the spread of epidemic diseases.

g. The seventh moderately low preferred context for learning mathematics is C23, construction and engineering. In the seventies (70's) and eighties (80's), construction and engineering were popular careers in Korea, but this has changed recently. This is a Korean social phenomenon which can be explained in several ways. According to Korean tradition, there is a social hierarchy based on the type of job you have, namely: Sa (administrative), Nong (agricultural), Gong (engineering and skill) and Sang (commercial). The value system, which is still embedded in the Korean mind till today influences people on what types of jobs to avoid from the lower hierarchies.

Construction and engineering salaries are relatively lower than that of medical doctors or lawyers. People involved in these disciplines are called 'blue colour' workers who focus on physical labour. Thus, from the nineties (90's), there has been a new focus on special exams to enter into the higher civil services. These include Haeng-Jeung Kosi (special exam for the administrative discipline), Eoi-Mu Kosi (special exam for the diplomatic discipline), Ko-Deung Kosi (special exam for the legal discipline) and many more. Learners are influenced by these kinds of social phenomena. Thus they are less interested in the topic of construction and engineering than other topics.

h. The eighth moderately low preferred context for learning mathematics is C11, environmental issues and climate change. Currently, there are serious environmental crises, as well as resource crises, which affect population growth, agriculture and food supply, fisheries, forests, fossil fuels, water and air quality. Climate changes, such as flood, drought, heavy snow, El Nino, etc. are widely recognized to be the result of these crises. Human

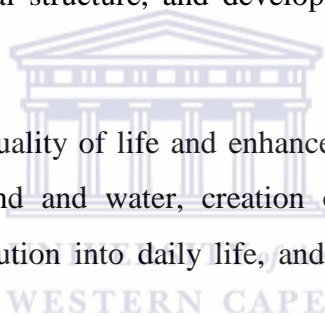
activities are causing severe environmental impact. Environmental crisis and climate change are becoming vital topics of concern at the United Nations (UN). To create and maintain a sustainable environment is one of the most urgent issues for present and future generations.

As a result, the Korean government established the presidential committee of Green Growth. It has three objectives;

1) mitigation of climate change and energy independence. It includes effective mitigation of greenhouse gas emissions, reduction of fossil fuel use and enhancement of energy independence, and strengthened capacity to adapt to climate change.

2) creation of new engines for economics. It involves development of green technologies, greening of existing industries, promotion of green industry, advancement of industrial structure, and development of structural foundation for green economy.

3) improvement of the quality of life and enhancement of international standing. It includes greening of land and water, creation of green transport infrastructure, bringing the green revolution into daily life, and becoming an international green growth role model.



Despite the urgency of these crises, learners do not take these issues seriously. These issues as they might think are the responsibility of the government to solve. It might be a reason as why learners rank this topic as their seventh moderately low preferred context for mathematical learning.

i. The ninth moderately low preferred context for learning mathematics is C6, government financial matters, such as inflation and taxes. Both C6 and C17 are related with financial literacy and financial mathematics or mathematical finance as mentioned earlier. Financial literacy refers to ‘the ability to make informed judgements and to take effective decisions regarding the use and management of money’ (Noctor, Stoney & Stradling, 1992). Financial literacy includes the following four elements (Schagen & Lines 1996:91, Davies & Brant, 2006:70).

- an understanding of the key concepts central to money management;
- a working knowledge of financial institutions, systems and services;
- a range of [analytical and synthetical] skills, both general and specific;
- attitudes which ...allow effective and responsible management of financial affairs.

Financial literacy has become increasingly important in recent years. However, financial literacy must be learned with mathematical thinking because only mathematics deals with “quantitative literacy.” Quantitative literacy is also termed numeracy, which is the ability to understand and reason with numerical information. That ability enables people to be comfortable with numerical data and to use them in meaningful ways, in particular to make well-reasoned decisions (Manaster 2009:68). In short, quantitative literacy is about how well mathematics can be used in life. Mathematics is the underpinning of quantitative literacy.

Financial mathematics as a branch of applied mathematics, it is a study of mathematics involving finance. Mathematical finance deals with the development of mathematical models arising from financial economics and their mathematical treatment. The main topics of financial mathematics include the pricing of derivatives, the evaluation of risk, and the management of portfolios. This subject has been one of the most active research areas among the probability and statistics community in recent years. Accordingly, learners must recognize the importance of financial mathematics.

According to a study by the Jump\$Start coalition in 2000 (Lusardi: 2007), young Koreans fared no better than their American counterparts when tested on economics and finance knowledge, with most receiving a failing grade. A study conducted by Korea Development Institute and Korea Economic Society showed that high school students got 37.6 points out of a possible 100% in financial education (Lee, 2010). Furthermore, only 16% and 22% gave correct answers to the question about risk management and credit management respectively.

This finding highlights the lack of financial education at school. Korean learners do not have enough time for financial education at school. The school curriculum focuses on the Dogu subjects for university entrance exam. Thus according to a study, 52.6% of learners think that time for financial education about government financial affairs is lacking. Seven and a half

percent (7.5%) of learners say that they have difficulty understanding of financial articles in news media.

The word 'Dogu' means tool. Thus the phrase 'Dogu subject' means basic tool for all subjects. For learners from grades 7 to 12, Dogu subjects include only three subjects namely, Korean language, English and Mathematics. These are regarded as the most important subjects for university entrance exams and for getting work. Financial education is not focused on these subjects and so learners have little interest understanding subjects such as economic phenomena, balance of payment, exchange rate, etc. Learners therefore do not prefer these topics for mathematical education.

j. The tenth moderately low preferred context to learn mathematics is C14, national and international politics. In Korean political history, student movements are well known. During the Japanese colonization of Korea, there were a number of student movements such as the Tokyo Yee Pal student movement for independent declaration and the Kwang-Ju student movement for independence. Although these movements were unable to achieve their aims, students were actively participating in the Korean political sphere. The end of the Second World War brought the liberation of Korea from the Japan.

During the first democratic government, the Sa-II-Gu student movement which took place on the 19th of April 1960, led to the president stepping down from office. Soon after that, three army generals became the presidents of Korea as they each led democratic governments. Freedom of expression, however was limited. Thus the topic of politics was forbidden to students. Since after this, Korea has had civilian governments.

Under the civilian administrations, politicians have become key figures in Korean society. Many presidents have been connected with corruption, and have been sentenced to prison and so are their family members. Some parliamentary national representatives have also been linked to corruption and bribery, thereby betraying the Korean people. Thus both politicians and politics are topics neglected by Korean youth.

The Office of Ministry of Special Affairs performed a Gallup poll from 17th of August to 9th of September 2010. The participants were adults 1018 and youth 730. According to this result, 85.6 % of the youth do not trust politicians and 13.4% had a positive viewpoint (Jung, J-H

2011). They think that politicians lie, fight every day and are self-centred and greedy. Some students even hold the viewpoint that politicians are tricksters. Due to this negative perspective, school learners are not interested in student organization elections and have selected politics as the ninth moderately low preferred context to learn mathematics.

k. The eleventh moderately low preferred item is C2—mathematics linked to Korean traditional games, such as “yut. “Yut” is one of the most popular traditional Korean games played on New Years’ Day. In Korea, New Year’s Day is the longest and most popular public holiday and lasts for three (3) days. Because of the Korean use of the lunar calendar, New Year’s Day is either in January or February every year. Traditionally, during New Year, Korean families come together and spend time with each other by playing traditional games. This game is played in two or three groups with five short sticks, originally meant as a game for communities in the agricultural age. Playing Yut can be related with “number of cases” and mathematical probabilities.

In general, Korean traditional games are related with mathematic applications in one way or another. Thus these games are very useful for mathematic education, as well as the development of human relationships. These games, however, are not well utilized for this purpose of mathematics learning for the following reasons:

1) mathematics text books rarely contain the concept of traditional games as a tool of mathematics education. The most important objective of mathematics education is to have high achievements and because of this, teachers must mainly use textbooks for educational purposes. Traditional games in mathematics are not a familiar concept to learners.

2) modern information technology is required urgently in Korean society and traditional games are left far behind. Learners focus is on smart phones with camera, mp3, television, SMS, email and internet capabilities. These two factors contribute to learners choosing traditional games as the tenth moderately low preferred context for learning mathematics.

Recently, concerned Korean educators were challenged by PISA results, which report low interest and low self-efficacy of Korean learners in mathematical education. In order to increase the degree of interest, and creative power, they try to utilize traditional games in mathematics teaching (for instances, Shin, et al. 2004).

1. The twelfth moderately low preferred it is C8— determining the level of development regarding employment, education and poverty of my community. There are two ways of understanding poverty. Absolute poverty is the lack of basic human needs such as clothing, food, and residence. Relative poverty is the condition of having fewer resources or less income as compared to others within a society or country. In Korea, there were severe levels of poverty before the seventies. Poverty eradication was significantly important to Koreans. Thus the Korean government initiated Saemaul Undong as a national movement in order to eradicate poverty, specifically by focussing on community development in rural areas. Primary school children participated in this movement.

With this, the Korean government began to develop secondary industries through science and technology. This has had great results for our national wealth: Korea's gross national income (GNI) was about \$19,830 in 2010 and Korea is a member country of G20. Korean youth, however, may still encounter *chronic poverty*, *life-course poverty* and *intergenerational poverty*.

1. Chronic poverty is poverty that is ever-present and never ceases. The cause of chronic poverty includes economic, social, political, and environmental factors.
2. Life-course poverty denotes the ways in which a poor child or young person can grow into a poor or even poorer adult. Life-course poverty has connection with life-course events, including but not limited to leaving school, starting work, getting married and having children, which plays a significant role in altering one's vulnerability to poverty.
3. Intergenerational poverty refers to transmission of poverty from one generation to the next via the transfer or non-transfer of poverty-related assets and capital, and is a useful concept for understanding youth poverty.

In Korea, the concept of the community poverty eradication is not applicable to learners due to their relatively affluent backgrounds. Rather, the concept of well-being or welfare is applicable and these are key concepts.

4.2.4. “Zone of lowest preference” real life situations in grade 8-10 Korean learners

The only lowest preferred item is C5—agricultural matters. In the sixties (60’s) and seventies (70’s), the agricultural industry was regarded as the backbone of the South Korean society. Specifically in the seventies, the Sae-Ma-Ui Undong initiated by the Korean government contributed to poverty eradication and to a better life. With agricultural businesses as the main source of income, this movement focused on community development. During this period, government subsidized youth participation in all agricultural matters in order to encourage and develop all agricultural matters.

Under the Saemaul Undong initiative, there was rapid development of the manufacturing industry. This industry needed a lot of human labour leading to huge migrations from the rural to urban areas. Furthermore, factories began to offer study opportunities to youths who were unable to afford education otherwise due to poverty. This period thus marked a shift in preference from the rural to the urban life style.

In 1986, there was an international meeting in Uruguay, which finally led to the establishment of the Marrakech agreement in 1994. As a result, South Korea was bound to import agricultural products from other countries. After this, the Free Trade Agreement (FTA) was established between South Korea and other countries. According to the FTA, South Korea must import agricultural products in order to allow the exportation of products from secondary industries. The change from being a primary industry country in the seventies and eighties to focusing on secondary and tertiary industries meant that the agricultural business has lost the momentum in Korean society.

There were two basic reasons for the lessened popularity of the agricultural business. The agricultural industry demands more physical labour than other sectors even though it has been modernized to some degree. Secondly, the income that can be earned from working in agriculture is relatively lower than in other sectors.

4.3. Discussion and Conclusion

The clusters of the highest and moderately high preference mathematical learning contexts are linked to youth culture which learners are usually and easily engaged with in one way or another. These clusters include the sports, leisure and recreation cluster (C18, C21), popular youth culture (C3), and the technology cluster (C10, C4). The lowest and moderately low preferred mathematical learning contexts are related to the political cluster (C14), financial (C6, and C17), health cluster (C20 and C7), and agricultural cluster (C5). These contexts are linked to the clusters that parents usually pay more attention to in daily life.

The quantitative results illustrate that Korean youths of grades 8-10 do show particular preferences in terms of the context for learning mathematics. The discussion above can only lead us to conclude that learning contexts for school mathematics preferred by the youth in Korea reflect a lack of understanding of the real-world situations and this has led them to have difficulties in adapting their mathematical knowledge to real-world situations. But as a word of caution, activities for the incorporation of real-life issues cannot solely be driven by the learners' preferences. It is a careful balancing of the preferences of the different stakeholders that must be catered for as suggested by Julie (2005).

WESTERN CAPE

CHAPTER 5: Qualitative Results and Discussions

5.0 Findings and Discussion

5.1 Introduction

This chapter presents the findings of data obtained through the interview phase of this study. In order to analyze learners' perspectives concerning their preferred contexts for mathematical education, data were collected by using 7 cards as probes for the in-depth interviews mentioned in chapter 3. This chapter presents the findings obtained within the framework of grounded theory. From the data, key points are marked with a series of codes which are extracted from 25 learners' (13 females, 12 males) interview data, and are then grouped into similar concepts. Categories were then formed, which are the basis for the creation of a theory.

5.1.1. General View on the Findings

The interview questionnaires consist of three main questions. Which categories do learners most prefer to deal with in their mathematics classes, which are the least preferred, and the moderate categories. Learners then had to order their 7 cards in the order of most preferred to least preferred. These cards illustrated the following categories: computer games, storage of music on CDs and iPods; lotteries and gambling; sending of messages via SMS's and e-mails; secret codes such as PIN numbers to withdraw money from ATM's; Korean traditional games such as "yut"; farming and agricultural activities; and personal finance and business finances.

The interview results in Table 5.1 looks at the 3 most preferred cards. We see the three least preferred cards in Table 5.6 to 5.8 , and from Table 5-9 to 5.12 we see the 3 moderately preferred cards.

Table: 5.1. Most preferred cards selected by Korean grades 8-10 learners

Items	Coding	Category	Learner	Reason
1st Card 2: lotteries and gambling	Recreation	Enjoying gambling, card games . self-satisfaction . knowing how to perform tricks	mm1 mf4 mf9 mf10 mm6 mm7 mm8 (7/25)	. I have a lot of interest in gambling, card games like blackjack . winning the lottery and to have much money gives self-satisfaction . I like to know the trick
2nd Card 7: personal finance and business finances	Finance	Fulfilling future career lots of interest in business and management future business	mf3 mf6 mf8 mm4 mm10 (5/25)	.to fulfil a future career .to understand the relationship between their financial interest .to know more about money for a future in business
3rd Card 1: Computer games, storage of music on CD's and iPods	Technology	Future career, and improving the quality of life .Future jobs .Game complexities	mf1 mf11 mm3 mm9 (4/25)	.In the future, I will use electronics most, so I want to learn and to know about them .future job (interested in father's job) .Interested in game complexities and various elements

5.1.2 Findings

According to Table 5.1, the first most preferred card is (card 2): lotteries and gambling (7 out of 25). Learners prefer lotteries and gambling, because they enjoy games of chance. They see lotteries and winning as a quick way to improve their lives, and therefore want to understand the mathematics associated with games of chance. In other words, they want to understand the mathematics behind probability, and they think the lottery and gambling can be useful in learning mathematics. This indicated that the relationship between gambling and lottery was seen as encouraging learners to do mathematics.

There is sufficient literature on the importance of contexts to the affective domain of learning (e.g. Boaler, 1993a, 1994; Klassen, 2006; Clarke & Helme, 1998). According to McLeod (1989b:245-258), beliefs, attitudes, and emotions are parts of the affective domain in learning mathematics. According to McLeod (1991:100), value which has three components, “the attainment value of the task, its intrinsic interest, and its utility value for our future goals,” is important to improve learners’ mathematics ability”.

According to findings of a study which investigated what provides the most influence on mathematics teaching and learning, factors related to the pupils' attitudes, their perspective on the world of mathematics, and their social identity were highlighted (Gómez-Chacón, 2000). Positive attitudes and beliefs in learners will be reflected in improved performance and expectations of achievement in mathematics (Ignacio & Barona, 2006:19).

Leisure is perceived primarily as a positive force that enhances the lives of individuals and society as a whole (see Kelly & Godbey, 1992). Life’s satisfaction and well-being are generally conceptualised and assessed in terms of happiness, satisfaction, morale, quality of life, self-esteem, mental and physical health.

Leisure and recreation is more important to youth than any other group. Through leisure activity, they get exposed to many experiences, different life styles, activities, identities and social groups. In leisure and recreation activities, they find positive self-images, increased school performance and engagement in education institutions.

Korean youths are interested in lottery and gambling, and value this activity. They engage with modern technology and want to enjoy lottery and gambling, and perhaps educators can use issues related to this activity to improve learning mathematics. This does not in any way promote gambling. Most of the reasons for choosing the highest ranked lotteries and gambling were based on future possibilities, followed by reasons related to learning. The futuristic reasons in order of preference were: career prospects, business prospects, financial power and improvement of their future life.

All these categories have implications for monetary gain. This is an indication that the learners associated schooling with a better future. Hernandez-Martinez, Black, Williams, Davis, Pampaka & Wake (2008) found that students talked about mathematics as being useful and relevant to their future while others saw success in mathematics as a way to escape from their current circumstances. In their study they established that parental influence on higher education was strong. However, Korean learners face stressful circumstances concerning their studies, so they prefer to learn mathematics in contexts that they enjoy. In this study, they chose lotteries and gambling as the most preferred category, which educators can use to improve the learning experience. Reasons given by students for their choice are presented in Table 5.2.

Table 5.2: The 1st most preferred cards(card2): lotteries and gambling)(7 out of 25)

Mathematical elements Enjoying gambling, card games	I have a lot of interest in gambling and card games like Blackjack Mathematical elements determine a win or defeat in gambling Learnt maths through gambling & card games
Youth leisure activity Mathematics' learning	Reading people's minds Preferred youth leisure activity An easy approach to learning mathematics
Winning the lottery Self-satisfaction	Winning the lottery To have much money gives self-satisfaction
Knowing how to perform tricks	I like to know the trick
Many probabilities The utility value of mathematics	Thinking through many probabilities could be an advantage It does not only require the use of mathematics, but also other fields
Predicting the future Optimum mathematical methods	Little possibility of predicting the future Mathematical methods show the optimum way
Mathematical probability Little chance of winning Probability uses society and stocks trading Chance of working	Lotteries and gambling are related to mathematical probability Chances of winning are small because it is luck-based There's a probability of it being used in selecting society and company stocks

According to Table 5.1, the second most preferred card (card 7) is personal finance and business finances (5 out of 25). Learners chose personal finance and business finances

because of the possibility of spending money more efficiently, understanding financial interests, the possibilities of future careers, business management, an interest in Stock studies, engineering and the production of the products.

Learners preferred “personal finance and business finances” because of future utility, the possibility of managing business, the desire to earn money. Hence this also helps them understand the relationship between their financial interests and the fulfillment of future careers. On the whole, however, there was little interest in the stock market.

Mathematics is simply logic and reasoning. Mathematics is present in everyday life and is being used even when people do not realize they are using mathematical reasoning. The language of mathematics is universal. From balancing a cashbook, baking a cake or trying to choose which credit card offers the best deal, the logic of mathematics is being used.

There are a number of constructs or variables classified under the affective domain. These include attitude, beliefs, emotions, values (Zan & Di Martino, 2007) as well as preferences and interest (Trumper, 2006). Affect has been a topic of interest in mathematics education research for different reasons (McLeod, 1992). Some authors define interest as attitude (Krapp, Hidi & Renninger, 1992). The most commonly studied construct in the affective domain is attitude towards mathematics. This was popularized by Fennema & Sherman’s (1976) attitude scale. A number of studies have concentrated on studying affect in relation to classroom activities.

The OECD has launched a new project focusing on jobs for youth in 15 member countries namely: Belgium, Canada, Denmark, France, Greece, Japan, Korea, The Netherlands, New Zealand, Norway, Poland, the Slovak Republic, Spain, the United Kingdom and the United States. (OECD, 2006b). For many teenagers, finding a paid job is the central task, and the status of the work as formal or informal is of less importance. For many youths, this is taken for granted as part of the overall work experience. The key criteria for assessing their experiences tends not be about prestige but rather about whether or not they are treated respectfully (White *et al*, 1997).

Reasons for selecting the second most preferred card are found in Table 5.3.

Table 5.3: The 2nd most preferred cards(card7): personal finance and business finances (5 out of 25)

Earning money and spending money efficiently Desire to earn a lot of money	Desire to earn a lot of money Have little interest in stocks because there is a possibility of spending money more efficiently
Fulfilling future career lots of interest in business and management	To understand the relationship between their financial interest and to fulfil a future career Lots of interest in business and management
Future business	To know more about money for a future in business
High prospects knowing the price of products	The prospects are highly related to stocks, studying engineering Producing products by knowing the price of component parts
Future utility	Future utility Possibility of managing it efficiently by investing in stocks

According to Table 5.1, the third most preferred card (card 1) is: computer games, storage of music on CD's and iPods(4 out of 25). Future career, improving quality of life, enjoying computer games, saving information, future utility, future jobs, game complexities were some of the reasons learners provided for choosing this card.

Learners preferred computer games, storage of music on CD's and iPods because it helps one to improve the quality of life, enjoy computer games, learn how to save information, search for jobs, and to understand the complexities behind computer games and storage of information. Hence they have an interest in the mathematics of how the systems work.

According to Gómez-Chacón (2000), one of the variables with the most influence on mathematics teaching and learning related to the pupils' attitudes is their perspective on the world of mathematics, and social identity. The expressions of the youth culture are often influenced by the agenda of popular media. "Youth culture is locally differentiated and often forms distinct subcultures within the youth community" (Schreiner 2006: 117). People have different opinions as to whether the attitudes and values of youth will last throughout their

lives or will disappear. However, a popular view is that some values will last for that phase of life and vanish as youths grow older. Other values characteristic of that specific generation will remain and these values will have the potential of changing society in the future. Sociologists often assume that values that are developed at the young stages are likely to survive through other phases and influence them for the rest of their life (Frones, 1998; Hellevik, 2001). Therefore attitudes and values held by youths are often seen as a cultural mirror image of the future (Fauske & Oia, 2003).

In modern society, technologies are a compulsory part of daily social life and ensure that people can interact and communicate. In the last 10-30 years, the rapid and extraordinary expansion of technology occurred, the development of new media is an important counter the social shaping of technology (Flew: 2002: pp. 53).

New media is a broad term in media studies that emerged in the later part of the 20th century. For example, new media holds out a possibility of on-demand access to content anytime, anywhere, on any digital device, as well as interactive user feedback, creative participation and community formation around the media content. Another important promise of new media is the "democratization" of the creation, publishing, distribution and consumption of media content. What distinguishes new media from traditional media is the digitizing of content into bits. There is also a dynamic aspect of content production which can be done in real time but these offerings lack standards and have yet to gain traction.

Most technologies described as "new media" are digital, often having characteristics of being manipulated, networkable, dense, compressible, and interactive, e.g., the internet, websites, computer multimedia, computer games, CD-ROMS, and DVDs.

Korean youths are interested in computer games, storage of music on CDs and iPods and they value this activity. They engage with modern technology and want to enjoy computer games, storage of music on CD's and iPods and want to use future career, future utility and future job. Educators can use this activity to improve the learning of mathematics. Most reasons for choosing computer games, storage of music on CD's and iPods are their third highest ranked

activity and includes future utility, enjoying games, saving information followed by learning. The futuristic reasons in order of preference were: career prospects, future jobs and to improve their future life (Table 5.4).

Table 5.4: The 3rd most preferred cards (card 1): computer games, storage of music on CD's and iPods (4 out of 25)

Future career, and improving the quality of life	I am a student. I use electronics most often In the future, I will use electronics most, so I want to learn and to know about them I use computers, mp3s, pmp's
Enjoying computer games Saving information	I frequently play computer games I save information often I am interested in how mathematics is used in saving information
Future utility	Future utility
Future jobs Game complexities	Future career Future job (interested in father's job) Interested in game complexities and various elements

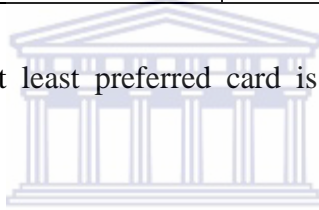
Findings in Table 5.5 looks at the three least preferred cards selected by Korean youths in grades 8-10.

Table 5.5. Least preferred cards by Korean grades 8-10 learners

Items	Coding	Category	learner	Reason
1st Card 6: Farming and agricultural activities	Agriculture C5	.lack of interest .gender difference .little connection to future career	mf3 mf8 mf10 mf13 mm3 mm5 mm7 mm9 mm10 (9/25)	.agriculture especially oceanic cultivation, does not interest me . agriculture is men's work, women don't need to know how to farm .little connection to future career
2nd Card 5: Korean	Sport and Recreation C2	. don't want to bring mathematical concepts in play	mm1 mf4 mf6	.just enjoy playing, don't want to bring mathematical concepts into it

traditional games such as “yut”		.no interest in disappearing traditions .boring	mf9 mm6 mm12 (6/25)	.I have no interest in disappearing national traditions .boring
3rd Card 2: Lotteries and gambling	Recreation C1	.violence in society: moral concerns .context/application .addiction	mf2 mf5 mf11 mf12 mm4 (5/25)	.respondents further argue that point because of the money involved, such games can result in violence .learning probabilities of mathematics, especially in games like the lottery, helps one to learn maths in real life .addiction (difficulty of resisting the temptations of gambling

According to Table 5.5, the first least preferred card is card 6) farming and agricultural activities (9 out of 25)



There are a number of constructs or variables classified under the affective domain. These include attitude, beliefs, emotions, values (Zan & Di Martino, 2007) as well as preferences and interest (Trumper, 2006). Young people find it difficult to adopt social changes, values and principles, and therefore one can easily find pronounced differences amongst different age groupings.

The 2002 survey of young Australians showed that their attitudes and achievements are determined at ages 27-28, as well as their reflections of their own journeys, since the study began in 1991 (Dwyer *et al* 2003), the author draws the conclusion that the post-1970 generation is generally positive. In 2002 “as many as 91% expressed real satisfaction with their own personal development”. Youths change priorities easily and look at the old and new in making sense of their world. Most of them feel that they have made the right choices. They are maintaining the right balance and challenging themselves in this regard. In this way they are practicing how to express themselves better.

Youths are spending more time with each other in educational institutions. They are developing good relationships based on this. De-traditionalisation, individualization and the youth's good relations in these educational institutions are contributing towards the development of youth culture (Frones, 1998: Heggen 2004).

Learners viewed agriculture, and hence the gender difference here, as a man's work. Lack of knowledge about agricultural activities that are linked to mathematics, little connection to future careers, little sense of satisfaction and pleasure and no future interest in the profession were seen as elements that discouraged learners from having interest in mathematics using agriculture as a learning context (Trumper, 2006).

Korean youths are not interested in farming and agricultural activities, and do not value this activity. Traditional Korean adults had to rely on manual labor such as farming work. Youths engage with modern technology and show a lack of interest and knowledge about farming and agricultural activities, so educators should be cautious if they use this activity in mathematics teaching if they have a goal to improve learning mathematics. One of many reasons for choosing this as their least ranked preference is that it was perceived as having no future opportunities and no value. The futuristic reasons in order of no preference were: career prospects, knowledge prospects, gender deference, talent difference, little satisfaction and little opportunity to improve their future lives.

Korean learners from all three groups do not enjoy working on the farm; their interest lies with technology concerning their future careers as they prefer to learn mathematics in contexts that they enjoy. This may be one reason they chose farming and agricultural activities as their least preferred category (reasons found in Table 5.6).

Table 5.6.: The 1st least preferred cards (card6): farming and agricultural activities (9 out of 25)

Lack of interest	.agriculture especially oceanic cultivation, does not interest me
Interest according to gender	.men can do it better and will be more interested

No interest	.not interested in that job
Gender difference	.agriculture is men's work, women don't need to know how to farm
Need talent	.no interest: only a few talented people need to learn
Mathematics is related to calculating an area	.mathematics is related to calculating a surface area. .calculating the area of figure
Lack of knowledge of the links to mathematics Lack of interest	.lack of knowledge about how farming and agricultural activities are linked to mathematics. .lack of interest
Little connection to future career	.little connection to future career
No knowledge, no interest or curiosity, no use	.no knowledge, no interest or curiosity .I can get information about healthy food from the internet about organic food, so it is not very useful
Little satisfaction	.little sense of satisfaction and pleasure after work is done
No future interest	.no future interest in this profession

According to Table 5.5, the second least preferred card (card 5) is: Korean traditional games such as “yut” (6 out of 25).

Youth culture, traditional games such as “yut”, leisure activities and enjoyment, entertainment, need to curriculum engagement were all noted as some elements encouraging learners to do mathematics. However, learners indicated that they dislike learning mathematics through leisure activities.

Learners viewed dance, traditional games such as “yut”, as elements that would influence learners in doing mathematics. For dance, they pointed out that since the person's movement requires sort of mathematical knowledge, it is important that one has an interest in mathematics. Learners observed that issues such as leisure activities, playing games, disappearing of traditions, entertainment have little or no relationship with mathematics therefore they dislike learning mathematics through the afore-mentioned activities.

Korean youth are not interested in Korean traditional games such as “yut” activities and do not value this activity. They engage with modern technology games and have a lack of interest and no knowledge in the Korean traditional games such as “yut”. Many reasons for ranking this activity as their second least includes their believe that yut offers no

entertainment, adds no value, lacks interest and boring, followed by learning. The reasons for not having interest in this category were: boring, no knowledge prospects, no entertainment, little influence, diminish effectiveness in their life (see reasons in Table 5.7).

All these categories have implications for leisure. This is an indication that the learners associated schooling with no enjoyment and as stressful. In Korean society, parents' influence on learners is strong. Korean adults do not like learners playing games and Korean learners prefer to learn mathematics in a context that they enjoy. They therefore choose Korean traditional games such as "yut" activities as the second least most preferred category.

Table 5.7: The 2nd least preferred cards (card5): Korean traditional games such as "yut" (6 out of 25)

Music/ popular youth culture Limited influence on math	.youth culture, such as dance, helps one to learn maths since a person's movement requires some sort of mathematical knowledge .traditional games, such as "yut", have limited influence on math because such games may diminish its effectiveness
Leisure activity Dislike of learning through mathematics Need curriculum engagement	.leisure activity (simple and enjoyable) .dislike of learning through mathematics .need curriculum engagement through other methods of playing
Do not want to bring mathematical concepts in play Possibly play games involving mathematical concepts	.just enjoy playing, don't want to bring mathematical concepts into it .respondents agree it is possible to play games involving mathematical concepts
No interest in disappearing traditions	.I have no interest in disappearing national tradition
No entertainment	.entertainment (fun) .no relationship with mathematics
Boring No correlation in traditional plays	.boring .mathematics has no relations to traditional games

According to Table 5.5, the third least preferred card (card 2) is: lotteries and gambling (5 out of 25).

Learners viewed lotteries and gambling as games of chance leading to violence, immoral activities, insincere work ethics, family breakdown, addiction, easy come and go money, bankruptcy, gap between rich and the poor, although this context was positive in influencing them to learn mathematics. The card was selected as the first most preferred (7/25) and also the least preferred card (5/25). Reasons for the selection of this card as least preferred are found in Table 5.8.

Table 5.8.:The 3rd least preferred cards (card2): lotteries and gambling (5 out of 25)

Violence in society: moral concerns Context/ application	.learning probabilities of mathematics, especially in games like the lottery, helps one to learn maths in real life .respondents further argue that point because of the money involved, such games can result in violence
Immoral activity Unethical working ethics addiction Breaking of family ties	.immoral activity .insincere working ethics .breaking of family ties .addiction (difficulty of resisting the temptations of gambling) .very easy to learn and to lose money .psychological enjoyment (interesting and fun)
Not good conduct Instant bankruptcy Do not use mathematics G&L because there is not a 100% chance of winning	.not good conduct .earn money easily and lose it easily .gambling can lead to instant bankruptcy .do not use mathematics G&L because there is not a 100% chance of winning
Big chance of earning and losing money Addicted people suffer negative consequences, loneliness and depression	.depending on the numbers, there is a big difference between the poor and the rich .addicted people suffer negative consequences, loss of money, indebtedness and lose of lives .bankruptcy may break the family, causing feelings of loneliness and depression
Suffer mental and material loss	.many people suffer mental loss and material loss

Table 5.9: Moderately preferred cards by Korean grade 8-10 learners

Items	Coding	Category	learner	Reason
1st Card 3:	Technology C16	.medium future utility	mf8 mf10	.medium future utility

Sending of messages via SMS's and e-mails		.global information exchange .message transport sector system appears to be complicated	mf12 mm6 mm7 mm8 mm10 mm11 (8/25)	.global exchange of information has become active and useful .although I use message transport sector system frequently for some reason, it appears to be complicated
2nd Card 2: Lotteries and gambling	Recreation C1	.feels motivated to play .purchasing power to increase economic activity .it's an abnormal amount of effort to earn a lot of money	mf3 mf6 mm3 mm5 mm9 (5/25)	.when I listen to the news, however, I feel motivated to play gambling and lotteries .positive point: money gained from gambling and lotteries increase purchasing power that increases economic activity .negative point: it's an abnormal amount of effort to earn a lot of money
3 rd Card 4: Secret codes such as PIN numbers to withdraw money from ATM's	Technology C4	.protection of identity .protecting information .use of mathematical devices to commit capital robbery	mf1 mf5 mf7 mm12 (4/25)	.if someone knows my information, sensitive information and files that are important to me can be leaked. .good point: protecting information from being lost .bad point: using mathematical devices to commit capital robbery

According to table 5.9, the first moderately preferred card (card 3) is: sending of messages via SMS's and e mails (8 out of 25)

The reasons for choosing this card includes: benefits, mathematics formulae, real life, information communication, learning of computers, learning of sms, e-mails, relationship with cell phones, message for transport sector, learning of mathematics principles, moderately influenced learners in doing mathematics.

Korean youth are moderately interested in the sending of messages via sms's, e mails, and moderately value this activity. They engage with modern technology but this also has negative consequences. The many reasons for ranking the sending of messages via sms's and e mails as their second moderate activity was because they see this as facilitating fast communication, it was fun and it allowed the global exchange of information. But it appears that it was too complicated to figure out the mathematical relationships in these activities (Table 5. 10).

Korean learners prefer anything that improves and better communication with each other and promotes social activity. This context would be moderately good as they prefer to learn mathematics in contexts that they enjoy. They therefore chose the sending of messages via sms's and e mails as their first moderately preferred category, and educators could use it to improve learners learning experience.

Table 5.10: The 1st middle preferred cards(card3): sending of messages via SMS's and e mails (8 out of 25)

Beneficial	Beneficial for me
Lack of mathematical knowledge Not interested Can use it in real life	.don't know much about mathematical formulae or mathematics itself, so I am not interested .use it in real life
Medium future utility	.medium future utility
ICT relating is fun	.ICT relating is fun
Medium interest Future utility	.medium interest .want to learn about character service and computers in the future
Learn mathematical principles	.to learn sms and e-mail principles mathematically
Little knowledge of cellular phone Global information exchange	.no deep relationship with cellular phone .global exchange of information has become active and useful
Message transport sector system appears to be complicated	.although I use message transport sector system frequently for some reason, it appears to be complicated

According to Table 5.9, the second moderately preferred card (card 2) is: lotteries and gambling (5 out of 25)

Learners viewed lotteries and gambling as an immoral activity, with negative consequences, and as contributing to purchasing power, abnormal income, broken families, fortunes, bankruptcy, crime and addiction. Learners prefers lotteries and gambling because they feel motivated to play, can win money and use mathematical principles to earn money (Table 5.11).

Table 5.11: The 2nd middle preferred cards (card2): lotteries and gambling (5 out of 25)

Immoral activity Negative consequences Feels motivated to play	.when I watch the news I see people arrested for gambling and it leads to family breakdown .when I listen to the news, however, I feel motivated to play gambling and lotteries
Like lotteries/dislike gambling Purchasing power to increase economic activity It is an abnormal amount of effort to earn a lot of money	.lotteries - placed first .gambling - .money gained from gambling and lotteries increase purchasing power that increases economic activity .it is an abnormal amount of effort to earn a lot of money
Use mathematics probability principle Broken family	.use mathematics probability principle and earn big money .addiction can cause lack of concern for the family
The big fortune - adapt mathematical principle The big loser –bankrupt	.the big fortune-adapt mathematical principles to lotteries and gambling .the biggest losers-people can't get anything, even lose property and become burglars
Gambling is my biggest concern	.gambling is my biggest concern though I think that it will not be useful

According to Table 5.9, the third moderately preferred card (card 4) is: secret codes such as PIN numbers to withdraw money from ATM's (4 out of 25)

Learners viewed electronic devices such as ATMs to be useful and were moderately interested to learn the mathematics behind it. Learners preferred secret codes such as pin numbers to withdraw money from ATMs as essential because the use of such devices helps one to protect one's identity. It allows protection of personal information, privacy, prevents capital robbery. It also facilitates the learning of future career skills and made them realise the value of learning mathematics.

The third category that Korean youth have a moderate interest in is secret codes such as PIN numbers to withdraw money from ATM's, and moderately value this activity (Table 5.12). They engage with information technology and want to protect their identities but this also has negative consequences like the stealing of information. One reason for ranking secret codes such as PIN numbers to withdraw money from ATM's as their third moderate preference was because of the theft of information, followed by mathematics learning. The futuristic reasons in order of preference were: career prospects, protection of information, , improving their lives. Educators can use the above to improve the learning of mathematics.

Table 5.12: The 3rd middle preferred cards (card4): secret codes such as PIN numbers (4 out of 25)

Use of electronic device Protection of identity Secrets of information and transaction How secure personal information is?	.ATMs are useful so I want to learn about that stuff. .if someone knows my information, sensitive information and files that are important to me can be leaked. .somebody can blackmail me with it or may use my information
Protecting information Stealing information Use of mathematical devices to commit capital robbery	.protecting information from being lost .using mathematical devices to commit capital robbery
Not producing skills for future career use	.neither easy nor is it difficult from the 7 card's themes .not produce skills for future career use
Using secret codes is marvellous Lack of interest in the principles	.inserting secret codes into the machine is marvellous but I don't have a lot of interest in the principles

5.3. Comparing Quantitative & Qualitative results

Questionnaire and interview results were as follows:

5.3.1. Item 1: computer games, storage of music on CD's and iPods

Quantitative results: second highest moderately preferred card was C10. Qualitative results: the third highest preferred card (card 1): computer games, storage of music on CD's and

ipods (4 out of 25). The quantitative and interview results were the similar and fell in the category of preferred to moderately highly preferred.

5.3.2. Item 2: sending of messages via SMS's and e- mails

Quantitative results: a moderately high preferred (C16). Qualitative results: the first moderately high preferred card (card 3): sending of messages via SMS's and e mails (8 out of 25). The quantitative and interview results were both moderately highly preferred cards.

5.3.3. Item 3: secret codes such as PIN numbers to withdraw money from ATM's

Quantitative results: a moderately high preferred card (C4). Qualitative results: the third moderately high preferred card (card 4): secret codes such as PIN numbers to withdraw money from ATM (4 out of 25). The quantitative and interview results were similar falling in the same moderately high category.

5.3.4. Item 4: lotteries and gambling

Quantitative results: a moderately low preferred card (C1). But three different results were found for the qualitative findings. Qualitative results:

- the first highly preferred card (card 2): lotteries and gambling (7 out of 25)
- the third lowest preferred card (card 2): lotteries and gambling (5 out of 25)
- the second moderately high preferred card (card 2): lotteries and gambling (5 out of 25)

The quantitative and interview results were totally different depending on each category (most preferred, least preferred, middle preferred). It is clear that lotteries and gambling are most attractive in that, one can easily earn money and become rich. Yet, there is also a lot of risk involved such as possibly losing money and breaking up family ties. In the quantitative analysis (the second moderately low preferred context for mathematical learning is C1, "lotteries and gambling."), the students were not able to raise these concerns but in the interviews, they were able to express their thoughts. Although controversial, it appears that this item is an attractive item to raise learners' interests to learn mathematics, but caution is proposed.

5.3.5. Item 5: personal finance and business finances

Quantitative results: a moderately low preferred context for mathematical learning (C17).

Qualitative results: the second highly preferred card (card 7): personal finance and business finances (5 out of 25). The quantitative and interview results were totally different. On the one hand it might be attractive because it can teach students more about personal finance and business finances so that they can learn how to earn money and spend it wisely. In the quantitative analysis (the fourth moderately low preferred context for mathematical learning is C17, “personal finance and business finances.”), learners were not able to express why they ranked this item so low.

5.3.6. Item 6: Korean traditional games such as “yut”

Quantitative results: a moderately low preferred context for learning mathematics (C2).

Qualitative results: the second lowest preferred card (card 5): Korean traditional games such as “yut” (6 out of 25).

The quantitative and interview results were totally matched, leading me to conclude that Korean traditional games such as “yut” are national traditions but fast disappearing as learners see it as boring and do not enjoy playing it. In the quantitative analysis (the tenth moderately low preferred context for mathematical learning is C2, “mathematics linked to Korean traditional games, such as “yut.”), the students were not able to provide reasons for their dislike for “yut” as a context for learning mathematics.

5.3.7. Item 7: farming and agricultural activities

Quantitative results: the lowest preferred context for mathematical learning (C5). Qualitative results: the first lowest preferred card (card 6): farming and agricultural activities (9 out of 25)

The quantitative and interview results were totally matched. Students disliked these as careers and contexts because both farming and agricultural activities demands more physical labour than other jobs, even though it has been modernized to some degree. Additionally, the wages that can be earned from working in agriculture is relatively lower than other jobs. It is clear that they dislike the idea of mathematics being taught using this context.

In summary, the card items were:

Item 1: computer games, storage of music on CD's and iPods: similar

Item 2: sending of messages via SMS's and e- mails: similar

Item 3: secret codes such as PIN numbers to withdraw money from ATM's: similar

Item 4: lotteries and gambling: similar

Item 5: personal finance and business finances: different

Item 6: Korean traditional games such as "yut": match

Item 7: farming and agricultural activities: match

Items are grouped into three groups based in the comparison of the quantitative and qualitative findings. The three groups are:

- a. items that match exactly (item 6, item 7)
- b. items that are similar but not a direct match (item 1, item 2, item 3, item 4)
- c. item that is very different (item 5).

Overall interview questionnaires and interview results are similar or matched except item 5.

So the interviews largely confirm the findings of the quantitative findings found in chapter 4.

The interviews also afforded the researcher the opportunity to probe for reasons for choices made by respondents.

6.0 Conclusion

This chapter explored the ROSME II data using grounded theory. The result is that the instrument to ascertain students' context preferences for use in mathematics is well acceptable since it was able to expose the contexts learners prefer to use for the learning of mathematics and the instrument findings correlate largely with the qualitative findings obtained by means of the interviews.

Again, the categories of the most preferred mathematical learning contexts are linked to youth culture and show that things youth are interested in doing and also are keen to see as contexts for the learning of mathematics. These categories include the sports and recreation,

technology, and finance. Learners usually pay more attention to enjoying life, their future careers, solving financial needs, and learning to use technology for use in their daily lives.

In summary, the most preferred context for mathematical learning is lotteries and gambling (sports and recreation cluster). The Korean youths enjoy games of chance such as lotteries and gambling. They also want to earn money without having to work very hard for it and they are keen to know the mathematical “tricks” to improve their luck of winning. Technology (iPods, storage of music, secret codes, sending of emails and sms’s) were also in the most preferred cluster.

Korean learners selected agricultural matters as the least preferred contexts for mathematical learning. Agriculture involves physical labour. It is the least popular context and yet was once popular in the period of Saemaul Undong. Today, there has been a drastic change from agriculture to manufacturing in Korea, so learners avoid the 4D works (Dirty, Difficult, Danger, Distance). Furthermore, many Korean people avoid the agricultural sector because of the low income in comparison with other jobs. Migration has taken place from rural to urban areas. Overall the national dance “yut” was also clustered in the least cluster.

The subject called mathematics is regarded as one of the tool subjects (or Dogu subject) or foundational subjects; this along with the Korean and English languages. As such, mathematics today is very important and mathematical knowledge is required in every area in daily life. Furthermore, mathematical knowledge acquired from learning in various contexts contributes to developing creative ideas into real life situations, products or events. Korean school mathematics emphasises that mathematics will help learners learn mathematics at universities and colleges. The Korean mathematics curriculum is linear and based on a scope and sequence of skills and algorithms. Thus first learners acquire the knowledge and skills of mathematics and then use mathematics for problem-solving in real world settings. This is a distorted view of mathematics as a science (Steen, 1990).

Learners must learn mathematics in various contexts in order to increase mathematical literacy in their daily life. Mathematical literacy or ‘mathematical power’ refers to the ability

through which a person is able to reason, analyze, formulate, and solve problems in a real-world setting. It is the ability to interpret and analyze the vast amount of information obtained through newspapers, television and on the internet in daily life. Mathematical power is the ability to discover problems. This is related to “Realistic Mathematics Education” or “Mathematics in Context” (Kim, 2006).

The next chapter provides the conclusions for the study and provides recommendations for future research and policy related to the context for the teaching of mathematics in Korean high schools.



CHAPTER 6: Conclusions

6.0 Conclusion

6.1 Introduction

This study discusses the findings in the contexts in which Korean learners of grades 8 to 10 would prefer in dealing with mathematics education. To investigate this problem, quantitative and qualitative research questions were asked.

The main research question was, *“What are the contextual situations Korean learners in grades 8-10 prefer to deal with in mathematics classroom?”*

To answer question one (1), the 23 core contexts were arranged into the zone of highest preference (with rank 4), the lowest preference (with rank 3), moderately high (with rank 7) and moderately low (with rank 9) preferred contexts. This helped identify how each core context was rated by the learners before doing a thorough study. Studying all the 23 core contexts gave a general picture of the nature of the high, low, moderate high and moderate low preferred contexts. Reasons for high, low, moderate high and moderate low preferred contexts were also studied.

In summary, the most preferred context for mathematical learning is lotteries and gambling (sports and recreation cluster). Technology (iPods, storage of music, sms and email messages, secret codes) were also in the most preferred cluster. This shows a strong focus on the kinds of things youth today are generally busy with – that is, technology and the use of it to entertain and create.

Korean learners selected agricultural matters as the least preferred contexts for mathematical learning. The national dance “yut” was also clustered in the least cluster. Much of the lack of interest in these categories has to do with youth yearning for modernity. Yut is a traditional game and youth are not generally interested in tradition. Agriculture has been greatly modernised but perhaps not well advertised to youth in terms of career opportunities.

6.2. Recommendations

This study investigated the contexts in which Korean grades 8 to 10 learners would prefer to learn mathematics. It is certain that such contexts would contribute to the enhancement of learners' mathematical power in the 21st century as the importance of mathematics will be recognized even more.

The clusters of the highly preferred mathematical learning contexts are linked to youth culture which learners are usually and easily engaged with in one way or another. These clusters include the sports, leisure and recreation clusters. The least preferred mathematical learning contexts are related to agricultural matters and traditional dance (C2: yut).

The highly preferred context for mathematical learning is linked to "recreation, physical exercise, sport activities and competition". The most frequent recreational activities belong to vicarious behaviours such as watching TV and listening radio. The characteristic of vicarious behaviour is the passiveness of the participants. Learners prefer active roles in recreation like physical and competitive behavior and thus educators should engage them more in such activities.

Since Korean educators regard national power in the competitive global society to be measured by the country's mathematical power, they want to know the achievements of their learners in comparison with learners from other countries. These comparisons are assessed through participation in international tests such as the TIMSS, PISA and IMO and the result obtained assists in evaluating the current educational curriculum. These tests are carried out to measure mathematical knowledge as well as functional application of mathematics in real world contexts. Korean learners have obtained high ranking achievements in the recent past and at the same time revealed their weak points.

In benchmarked tests, Korean learners in general have an excellent international record, but in the advanced international benchmarks, they retain the third position with 35%. This is low considering the competitiveness in the 21st society of today. This phenomenon might be

caused by the ‘PyungjunhwaKyoyuk system’, that is this system allocates learners to schools regardless of academic ability by random selection. In this context, I identified that the Korean education policy must be reconsidered specifically in ways of producing more excellent learners in order to enhance the country’s national power. In summary, Korean learners should be encouraged to participate more in international tests to assess their competitiveness.

In the applications of mathematics in daily life, only 17% of Korean learners could relate mathematics to real life situations as observed in this study. This percentage is very low in comparison with the international average of 44%. This implies that Korean mathematics education puts more emphasis on computation and algorithm skills, and that the lack of understanding of real-world situations has led learners to have difficulties in adapting their mathematical knowledge to real-world situations. Policy reviews should be conducted so as to incorporate real-life games or situations learners prefer into curricula.

To further explain the importance of real-life inclusions into curricula, learners’ interest in learning mathematics vary and depends on the teacher’s ethos, which includes method, content of mathematics including extra materials and the learning context. In this study, I investigated the degree of learners’ interest in contexts preferred by learners. This study employs the questionnaires of the ROSME II project and discovered that the highly preferred context for learning mathematics is the topic “recreation, physical exercise, sport activities and competitions”.

The main interest of Korean learners is to move out of stress related to study pressures and to enjoy using new media technology. The further they progress in their school studies, the more time they must spend on school-work, with increasing stress. If they have the opportunity, they want to relieve themselves from stress and express their own ideas. For this reason the Korean learners will look for mathematics that entertains and surprises them, however “recreation, physical exercise, sport activities and competitions” must be understood in a wider sense than “Mathematics of Entertainment, or the Entertainment of Mathematics” since the degree of entertainment depends on individuals. It is strongly recommended that

educators should offer opportunities to increase learners' interest in classroom activities, for example by using games in the classroom to teach mathematics.

The ROSME II questionnaires were originally developed for the South African context, thus making some of the items inappropriate for the Korean study. Therefore the ROSME questionnaires should be adapted for the Korean context using Korean items specific to the Korean environment.

Korea has today become one of the best IT (Information Technology) hub countries in the world. By this, mathematics curricula and materials appropriate to learning mathematical context must be available to enhance a better and efficient mathematics education. Thus, the Korean educational and school system has a responsibility to develop particular programs for nurturing learners' mathematical prowess.

6.3 Conclusions

The research problem in this study addresses the lack of learners' preferences in contexts chosen for learning mathematics. The main aim was to find and study the contexts that the learners preferred and also study the reasons they gave for preferring these contexts. Studying the nature of the contexts they preferred coupled with the reasons they gave for preferring the contexts exposed the identities they have about mathematics as well as their self-identities in relationship to mathematics. For any communication to be successful it is important to know the audience very well. As educators, our audience is the learners.

The study indicates that learners were interested in issues that were of concern to enjoying their lives and future utility of mathematics. This indicates that they were aware of what is important for their future careers. Enjoying recreational activities is a way to escape from stress. Their interests also included the technological contexts; making computer games and storing music and videos on CD's and iPods. They showed interest in the use of social networks and also in academic work.

Studying the reasons learners gave for preferring contexts revealed their perceptions of the value of school mathematics. This was particularly evident in their reasons for preferring to

learn mathematics that arises while they are learning another subject. It revealed their beliefs, emotions and behaviours in relation to mathematics were classified under “positive attitudes to mathematics.” An example of an attitude related to emotions was “I like mathematics”. One related to beliefs is “mathematics is useful” and one related to behaviour was “I always do my maths homework” (Zan & Martino, 2007).

6.4 Implications for Policy and Practice

A learner-centered policy is already in place but whether it is implemented is yet to be seen. Secondly this policy focuses more on classroom instruction and omits learner consultation. Learners information have shown that they want a curriculum that recognises the changes in the environment, an example is technological changes. Consulting learners is not compatible with an examination oriented system. Studies in science education have indicated that learners preferred to be taught using the traditional methods as educators are not sure about contextualizing (Dlamini & Dlamini, 2003; Dlamini, Dlamini & Dube, 2007). For contextualizing to be effective, the system of education needs to review its assessment methods to incorporate contextualizing.

Learners should be consulted with regards to their studies especially with regards to what interests them, although this consultation should be minimal so as not to lose sight of the purposes of learning. This study has shown that learners believed learning in these contexts would enhance learning. In some instances the learners showed keen interest in the contexts itself. It is an indication that these contexts could motivate them to learn mathematics. The large number of learners who showed an interest in learning mathematics while learning other subjects is a challenge to educators in training as it presents a holistic view of knowledge creation and acquisition from varying perspectives. Alternative methods in teaching mathematics should be explored through policy reviews as some learners did report of instances where they claim some teachers of some other subjects taught better.

Positive attitudes and belief in learners will be reflected in improved performance and expectations of achievement in mathematics. Ignacio, & Barona (2006:19) found that pupils with a high or satisfactory level of performance, unlike those with a low or unsatisfactory

level, enjoy a more positive self-concept, have higher expectations, get better marks, and are more likely to attribute the cause of success to effort. Providing students with at least some of the contexts they prefer for the teaching and learning of mathematics can have a motivating effect on their learning of mathematics and their love for mathematics.



References

- Aagre, W. (2003). *Ungdomskuunskap.Hverdagslivetskulturelle former* [Youth knowledge. The cultural shapes of everyday life]. Bergen: Fagbokforlaget.
- Andrich, D. (1988). *Rasch models for measurement*. Newbury Park, CA: Sage Publications.
- Ajayi, K. O. Lawani, A. O.Salomi, Modupe. O. (2012) The Influences of Self-Concept and Academic Motivation on Students' Attitude to Mathematics in Selected Secondary Schools in Ogun State, Nigeria they asserted European Journal of Scientific Research, vol.67 No.3, pp. 444-455. Available from. <http://www.europeanjournalofscientificresearch.com>
- Allport, G.W, (1935). *Attitudes: A Handbook of Social Psychology*. Ed. C. A. Murchison. Vol.2. New York: Russell.
- Barnes, M. S. (2006). A Comparison Between the Contexts Learners in Grade 8, 9 and 10 Prefer for Mathematical Literacy. Unpublished thesis submitted in partial fulfilment of the requirements for the M.Ed degree in the Faculty of Education, University of the Western Cape.
- Barton, B. & Fairhall, U. (1995). Is mathematics a trojan horse? In B. Barton & U. Fairhall (eds.), *Mathematics in Maori education*. (pp. 1-12). Auckland: The University of Auckland.
- Beaton, A. E., Martin, M.O., Mullis, I.V.S., Gonzalez, E.J., Smith, T.A., & Kelly, D.L. (1996). *Mathematics achievement in the middle school years: IEA's third international mathematics and science study (TIMSS)*. Chestnut Hill, MA: Center for the Study of Testing, Evaluation, and Educational Policy, Boston College
- Beck, Ulrich & Beck-Gernsheim, Elisabeth (2002) *Individualization: Institutionalized Individualism and its Social and Political Consequences*. London: Sage.
- Bishop, A.J. (1988) *Mathematical Enculturation: A cultural perspective on Mathematics Education*. Dordrecht: Kluwer Academic Publishers.
- Blaauw, C. (2009). A Comparison of Grade 8 to 10 urban and peri-urban learners context preferences for Mathematical Literacy. Unpublished thesis submitted in partial

fulfilment of the requirements for the M.Ed degree in the Faculty of Education,
University of the Western Cape.

Bloom, B. (2008) 2012.06.02 retrieved

http://www.newworldencyclopedia.org/entry/Benjamin_Bloom

Boaler, J. (1993a). Encouraging the transfer of 'school' mathematics to the 'real world' through the integration of process and content, context and culture. *Educational Studies in Mathematics*, 25, 341-373

Boaler, J. (1994). When do girls prefer football to fashion? An analysis of female underachievement in relation to 'realistic' mathematics contexts. *British Educational Research Journal*, 20(5), 551-564

Bond, T. G. & Fox, C. M. (2001). *Applying the Rasch model: Fundamental measurement in the human sciences*. Mahwah, NJ: Lawrence Erlbaum

Brousseau, G.(1997). *Theory of Didactical Situations in Mathematics*. Norwell, MA: Kluwer Academic Publishers

Busse, A., & Kaiser, G. (2003). Context in application and modelling – an empirical approach. In Ye, Q-X., Blum, W., Houston, S. K. and Jiang, Q-Y (Eds) *Mathematical Modelling and Culture*. Chichester, England: Horwood Publishing Limited

Carlson, R., Siegal, H., & Falck, R. (1995). *Qualitative research methods in drug abuse and AIDS prevention research: An overview* [Online]. Available: www.wright.edu [2006, May 3]

Chapman, O.(2006). Classroom practices for context of mathematics words problems. *Educational Studies in Mathematics*, 62, 211-230

Cho, J-O.(2008). *A study on recreational activities and their usefulness*. Retrieved on March 2011, from http://gds.kookmin.ac.kr/site/cms_file/images/100_199/181/D2004510.pdf

Choi, D-J., Oh, K-T., & Seo, B-K.(2010). *A study on internet addict 2010*. National Information Society Agency

City of Kingston (2006): *Youth Leisure Needs Study* pp.3-4

Clarke, D.,&Helme, S. (1998). Contexts as construction. In O. Björkqvst (Ed.), *Mathematics teaching from a constructivists point of view* (pp.129-147) ÅboAkademi University

Cobb, P.. (2000). *Conducting teaching experiments in collaboration with teachers*. In Kelly, A. &Lesh, R. (Eds.), *Handbook of research designs in mathematics and science education* (pp. 307-333) London: Lawrence Erlbaum Associates.

Colby, K. M. (1973). "Simulations of Belief Systems."In Rodger C. Schank& Kenneth M. Colby (Eds.), *Computer Models of Thought and Language*. San Francisco: Freeman.

Coleman, J.C. & Hendry, L.B. (1999).*The Nature of Adolescence*. London: Routledge.
Congress on Mathematical Education (ICME)-10, July 4-11, 2004, Copenhagen.

Cornellison, M. S. (2008). A Comparison Between the Contexts Learners in Grade 8, 9 and 10 Prefer for Mathematical Literacy and Gender. Unpublished thesis submitted in partial fulfilment of the requirements for the M.Ed degree in the Faculty of Education, University of the Western Cape.

Corno, L., Cronbach, L., Kupermintz, H., Lohman, D., Mandinach, E.,Porteus, A., & Talbert, J.(2002).*Remaking the concept of aptitude: Extending the legacy of Richard E. Snow*. Mahwah, NJ: Lawrence Erlbaum Associates.

Davies, P & Brant, J.(2006).*Business, economics and enterprise: teaching school subjects 11-19*. NY: Routledge.

Dapueto, C.,Parenti, L. (1999) Contributions and Obstacles of Contexts in the Development of Mathematical Knowledge.*Educational Studies in Mathematics*, 39(1-3), 1-21.

DeBellis, V. A. & Goldin, G. A. (1997). The Affective domain in mathematical problem solving. In E. Pehkonen (ed.), Proceedings of the 21st Conference of the International Group for the Psychology of Mathematics Education,, Vol. 2 (pp. 209-216). Finland: University of Helsinki.

De Bock, D.,Verschaffel, L.,Janssens, D., Van Dooren, W.,&Claes, K. (2003) Do Realistic Contexts and Graphical Representations Always Have a Beneficial Impact on Students' Performance? Negative Evidence from a Study on Modeling Non-Linear Geometry Problems.*Learning and Instruction*, 13(4), 441-463

De Roos, Y.& Allen-Meares, P. (1998). Application of Rasch analysis; Exploring differences in depression between African-American and White children. *Journal of Social Service Research*, 23, 93-107

Di Martino, P.,&Zan, R. (2001). Attitude toward mathematics: Some theoretical issues. Proceedings of 25th Annual Conference for the *Psychology of Mathematics Education*, 3,351-358

Dörfler, W. (2003). Mathematics and mathematics education: Content and people, relation and difference. *Educational Studies in Mathematics*, 54,(2-3), 147-170
Retrieved<http://www.springerlink.com/index/T0195167217K7370.pdf>

Dumazedier, J.(1960). Current problems of the sociology of leisure.*International Social Science Journal*. 12(4), 522-531

Dumazedier, J. (1967). *Towards a Society of Leisure*. London: Collier Macmillan

Durik, A. M., & Harackiewicz, J. (2007). Different strokes for different folks: How individual interest moderates the effects of situational factors on task interest. *Journal of Educational Psychology, 99*, 597-610

Dwyer, P., Smith, G., Tyler, D., & Wyn, J. (2003). Life-patterns, career outcomes and adult choices (Research report 23). Melbourne: Youth Research Centre (YRC), University of Melbourne

Eccles, J. S. & Harold, R.D. (1983). "Expectancies, Values, and Academic Behavior." Achievement and Achievement Motives. In Janet T. Spence (Ed.), *Psychological and Sociological Approaches* (76-146). San Francisco: Freeman

Eccles, J. S., & Wigfield, A. (2002). Motivational beliefs, values, and goals. *Annual Review of Psychology, 53*, 109–132

Eccles, J., & Wigfield, A. (2002). *Development of achievement motivation*. New York: Academic Press



Edwards, E., & Ruthven, K. (2003). Young people's perceptions of the mathematics involved in everyday activities. *Educational Research Journal, 45*(3), 249-260

Eivers, E., Close, S., Shiel, G., Millar, D., Clerkin, A., Gilleece, L., & Kiniry, J. (2009). *The 2009 National Assessments of Mathematics and English Reading*. Dublin: Department of Education and Skills

Fayers, P. & Hays, R. (2005). *Assessing quality of life in clinical trials: Methods and practice* (pp. 55-76). New York: Oxford University Press

Farlex, (2005). Farlex Free Dictionary. Huntingdon Valley, PA: Farlex, Inc. retrieved from <http://www.thefreedictionary.com/relevance> on Saturday, May 06, 2006

Fauske, Halvorogøia, Tormod. (2003). *Oppvekst I Norge [Adolescence in Norway]*. Oslo: Abstraktforlag

Flacks, R. (1971). *Youth and social change*. Chicago: Markham.

Flew, Terry (2002), *New Media: An Introduction*, Oxford University Press, UK

Forma, J. (1995). *Cultural Theory & Late Modernity*. London: SAGE Publications Ltd.

Frone, M.R. (1998). Predictors of work injuries among employed adolescents. *Journal of Applied Psychology [JAP]*, 83(4), 565 – 76.

Furlong, A., & Cartel, F. (1997). *Young people and social change: individualization and risk in late modernity*. Buckingham: Open university press

Goldin, Claudia. 1997. "Career and Family: College Women Look to the Past." In F. Blau and R. Ehrenberg, eds., *Gender and Family Issues in the Workplace*. New York: Russell Sage Press, pp. 20-58.

Gomez-Chacon, I.M. (2000). *Matemática emocional. Los afectos en el aprendizaje matemático [Emotional mathematics. Affects in mathematics learning]*. Madrid: Narcea

Hankyure Newspaper (2012). The secret of Mathematics in Finland which is the highest rank in interest. <http://www.hani.co.kr/arti/society/schooling/530505.html>

Heggen, K. (2004) *Risikoogforhandling. Ungdomssosiologiske emner [Risk and negotiation. Youth-sociological topics]* Oslo: Abstrakt <http://www.thefreedictionary.com/relevance> on Saturday, May 06, 2006 initiators . African Journal of Research in SMT Education, Instruction.

Hess, R. D., & Azuma, M. (1991). Cultural Support for Schooling: Contrasts between Japan and the United States. *Education Researcher*, 20 (9), 2-8

- Hidi, S., & Ainley, M. (2002). Interest and adolescence. In F. Pajares & T. Urdan (Eds.), *Academic motivation of adolescents*, (pp. 247-275). Greenwich Conn: Information Age.
- Holtman, L., Julie, C., Mbekwa, M., Mtetwa, D., & Ngcobo, M. (2011). A comparison of preferences for real-life situations that could be used in school mathematics in three SADC countries. *South African Review in Education*, 17. Online
- Ignacio, N. G., Nieto, L. J. B., & Barona, E. G. (2006). The affective domain in mathematics learning. *International Electronic Journal of Mathematics Education*. 1(1), 16-32.
- ILLERIS, K. (2002) *The Three Dimensions of Learning: Contemporary Learning Theory in the Tension Field Between the Cognitive, the Emotional and the Social*. Leicester, UK: NIACE.
- INSTAT (2005). *National Statistics Institution*, Tirane. Retrieved July 15, 2009 from <http://www.instat.gov.al>
- INSTAT (2007). *National Statistics Institution*, Tirane. Retrieved July 15, 2009 from <http://www.instat.gov.al>
- Jang, S-H., (2004). A study on the degree of satisfaction of recreational activities of children and youth (아동청소년의여가생활만족도에관한연구). Retrieved on March 2011, from http://kostat.go.kr/survey/lifestyle/ls_dl/2/index.board?bmode=read&bSeq=&aSeq=153678&pageNo=2&rowNum=10&navCount=10&currPg=&sTarget=title&sTxt=
- Julie, C., & Mbekwa, M. (2005). What would grade 8 to 10 learners prefer as context for mathematical literacy? The case of Masilakele Secondary School. *Perspective in Education*, 23 (3), 31-43
- Julie, C. (2006). Teachers' preferred contexts for Mathematical Literacy as possible initiators for Mathematics for action. *African Journal of Research in SMT Education*, 10(2), 49-58

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

Julie, C., & Holtman, L. (2008). The Relevance of School Mathematics Education (ROSME). In Holtman, L., Julie, C., Mikalsen, Ø., Mtetwa, D. & Ogunniyi, M. (Eds.) *Some Developments in Research in Science and Mathematics in Sub-Saharan Africa: Access, Relevance, Learning, Curriculum Research*. Somerset West (South Africa): African Minds. (pp. 379-405)

Julie, C., Holtman, L., & Mbekwa, M. (2011) Rasch modelling of mathematics and science teachers' preferences of real-life situations to be used in mathematical literacy. *Pythagoras*, 32(1), 30-38

Jung, J-H. (2011). 86% of Korean citizens do not trust Politicians. <http://www.datanews.co.kr/site/datanews/DTWork.asp?itemIDT=1002209&aID=20111018114202897&page=>. 데이타뉴스 (정지현. 국민 86%, “정치못믿겠다.”)

Jun, M-R. (2011). A study on Jazz Dance from educational perspective. www.dancetheory.pe.kr/spboard/board.cgi?id=library...view...

Kacerja, S. (2011) Albanian students' motives for preferring certain real-life situations for learning mathematics (in review with AOSIS Open journals).

Kaiser, G. (2005). *Mathematical modelling in school: examples and experiences*. Presented at The Fourth Congress of the European society for Research in Mathematics Education (CERME 4), 17 - 21 February 2005 in SantFeliu de Guíxols, Spain, YERME day: 16-17 February

Kaiser-Messmer, G. (1993). Results of an Empirical Study into Gender Differences in Attitudes towards Mathematics. *Educational Studies in Mathematics*, 25, 209-233

- Katagiri, S.(2006).*Mathematical Thinking and How to Teach it*. Progress report,“Collaborative Studies on Innovations for Teaching and Learning Mathematics in Different Cultures (II) - Lesson Study focusing on Mathematical Thinking –”.CRICED: University of Tsukuba
- Khalid, M. (2007).*Incorporating mathematical thinking in addition and subtraction of fraction: Real issues and challenges*.KhonKaen International conference, with the topic “Innovative teaching mathematics through lesson study (II): Focusing on mathematical thinking” held at KhonKaen in 16-20 August 2007. Retrieved on March 2011, from <http://www.crme.kku.ac.th/APEC/PDF%202007/Madiah%20Khalid.pdf>
- Kim, H-S.(2005). A study on recreational time and change of recreational activities in 5 school day system (주 5 일제수업실시에따른청소년여가시간및여가선호변화에관한연구) v. 12 (4).pp 59-82
- Kim, K-Y.,& Choi, S-H.(2003). *A study on the current situation of the economic education and its task*.Unpublished. Samsung Economic Institute
- 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 M.Ed degree in the Faculty of Education, University of the Western Cape
- Klassen, S. (2006). A theoretical framework for contextual science teaching. *Interchange* .37(1-2),31-62.
- Kola, A.(2009).Sashpenzuum ne njevit per telefonadhe internet. How much did we spend in one year in telephones and internet? Shqip. Retrieved June 3, 2009 from www.gazeta-shqip.com.al
- Köller, O., Baumert, J. & Schnabel, K. (2001). Does interest matter? The relationship between academic interest and achievement in mathematics.*Journal for Research in Mathematics Education*, 32, 448-470

Korean Youth Research (1993).(한국청소년연구제 4 권제 4 호 [통권제 15 호]
1993 년겨울 006)118.128.24.17/pub/docu/kr/BG/01/.../BG01-1993-S04-
006.HTM118.128.24.17/pub/docu/kr/BG/01/.../BG01-1993-S04-006.HTM

Krapp, A. (2000). Interest and human development during adolescence: An educational-
psychological approach. In J Heckhausen (ed), *Motivational psychology of human
development*, (pp. 109-128). London: Elsevier

Kunter, M., Baumert, J.,&Koller, O.(2007). Effective classroom management and the
development of subject- related interest. *Learning and instruction*, 17, 494-509

Lee, Ch-S.(2010). An analysis of the sense of urgency of youth in a local province
(지역사회청소년의위험인식분석). *A Journal of Korea risk management*
(한국위기관리논집). 6(3), 113-131

Lee, H-J.(2007). Conference proceeding the third Employment Panel of Korea Education.

Lee, M-H., &Kim, J-Y.(2005)*A study of the achievement by extra lesson*. Conference
proceeding the first Employment Panel of Korea Education held in Seoul National
University

Lee, S-J (이수정) (2010). *The lack of financial literacy of youth: Increase the time for
financial education at school* (청소년들경제지식부족: 학교서수업비중늘려야).
<http://pann.news.nate.com/info/250323373>

Lebeta, T. V. (2006). An investigation into pre-service teachers mathematical behaviour in an
application and modelling context. Unpublished thesis submitted in partial fulfilment of
the requirements for the M.Ed degree in the Faculty of Education, University of the
Western Cape.

Lesch, R. (1980).In S. Sharon & R. E. Reys (eds.),*Applications in School Mathematics*.
Reston, Virginia: National Council of Teachers of Mathematics.

Lepper, M. R. (1988). Motivational considerations in the study of instruction. *Cognition and Instruction*, 5(4), 289-309

Leung, F. K. S.(2001). In search of an East Asian Identity in Mathematics Education.*Educational Studies in Mathematics*, 4,35-51

Leung, F.K.S.,& Park, K. M.(2002). Competent Students, Competent Teachers? *International Journal of Educational Research*, 37 (2), 113-129

Lew, H-C.(2004). *Mathematics Education in Korea after TIMSS*.presented at the International Congress on Mathematical Education (ICME)-10, July 4-11, 2004, Copenhagen, Denmark

Likert, R. (1932). A technique for the measurement of attitudes.*Archives of Psychology*; No. 140

Linacre, J. M. (2004). *A user's guide to WinstepsMinistepRasch model computer programs*. Chicago, IL: MESA Press

Linacre, J. M. (2008). *A user's guide to WinstepsMinistepRasch model computer programs*. Chicago, IL: MESA Press

Lojerrat e fatitshtyjnetemituritdrejtkrimeve.*Lotteries and gambling push teenagers towards crimes* (2009, January 30).Shqip. Retrieved August 3, 2009 from www.gazeta-shqip.com.alkkk

Lusardi, A. (2007).*International evidence on financial literacy*.
<http://annalusakdi.blogspot.com/2007/11/international-evidence-on-financial.html>

- Ma, L.(1999).*Knowing and Teaching Elementary Mathematics*. Mahwah, NJ: Lawrence Erlbaum Associates Publishers
- Mason, J. (1996). *Qualitative researching*.London, Thousand Oaks New Delhi: Sage Publications
- Manaster, A.B.(2009). Mathematics and numeracy: Mutual reinforcement. In *Mathematics and democracy: The case for quantitative literacy*. Lynn Steen. Woodrow Wilson National Fellowship Foundation
- McKechnie, J. & Hobbs, S. (2002). Work by the Young: The Economic Activity of SchoolAged Children. In M. Tienda & W.J. Wilson (eds) *Youth in Cities: A Cross-National perspective*. Cambridge University Press: UK, pp 217-245.
- McLeod. D. B. (1989b). Beliefs.Attitudes. And emotions: new view of affect in mathematics education. In D.B. McLeod & V.M. Adams. (eds.). *Affect and Mathematical Problem Solving: a New Perspective* (pp. 245-258). New York: Springer-Verlag
- McLeod, S. H. (1991). The affective domain and the writing process: Working definitions. *Journal of Advanced Composition*. 11(1), pp. 95-105
- McLeod, D. B. (1992). Research on affection Mathematics Education: A Reconceptualisation. In D.A. Grows (Ed.), *Handbook of research on Mathematics teaching and learning* (pp. 575-596). New York, Macmillan
- McGrew, K. S.(2007). Beyond IQ: A Model of Academic Competence and Motivation *Institute for Applied Psychometrics*.Retrieved January 3, 2008, from <http://www.iapsych.com/acmcewok/map.htm>.
- Meaney, T.(2007).Weighing up the influence of context on judgements of mathematical literacy. *International Journal of Science and Mathematics Education*, 5, 681-704.
- Miles, S. (2000). Youth lifestyles in a changing world. Open University Press: Philadelphia.

Ministry of Culture, Sport and Tourism (2008). *White paper on Korean games: Guide to Korean game industry and culture*. Korea.

Mitchell, M.(1993). Situational Interest: Its multifaceted structure in the secondary school mathematics classroom. *Journal of Educational Psychology*, 85, 424-436

Murphy, J. F.(1974). *Concepts of Leisure: Philosophical Implications*. NJ: Prentice-Hall

Murphy, J. F.(1975). *Recreation and leisure service: A humanistic perspective*. Iowa:W. C. Brown Co

McLeod, S. H.(1991). The affective domain and the writing process: Working definitions. *Journal of Advanced Composition*. 11(1), 95-105

McLeod, D. B. (1992). Research on affection Mathematics Education: A Reconceptualisation. In D.A. Grows (Ed.), *Handbook of research on Mathematics teaching and learning* (pp. 575-596). New York, Macmillan

McLeod, D. B. (1989b). Beliefs, Attitudes, And emotions: new view of affect in mathematics education. In D.B. McLeod & V.M. Adams. (eds.). *Affect and Mathematical Problem Solving: a New Perspective* (pp. 245-258). New York: Springer-Verlag

Mullis, I. V. S., Martin, M.O., Gonzalez, E.J., Gregory, K.D., Garden, R.A., O'Connor, K.M., Chrostowski, S.J., Smith, T.A. (2000). TIMSS 1999: Findings from IEA's Repeat of the Third International Mathematics and Science Study at the Eighth Grade. Chestnut Hill, MA: The International Study Center, Lynch School of Education, Boston College

Mullis, I V S, Martin, M.O., Gonzalez, E.J., Gregory, K.D., Garden, R.A., O'Connor, K.M., Chrostowski, S.J., Smith, T.A. (2004). TIMSS 2003 International Mathematics Report: Findings From IEA's Trends in International Mathematics and Science Study at the Fourth and Eighth Grades. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Lynch School of Education, Boston College.

Neuman, W.L. (2000). *Social research methods: Qualitative and quantitative approaches*. USA: Allyn and Bacon

Ngcobo, M. (2006). *Contexts in which secondary school learners from selected private schools prefer to learn mathematics: Some findings from ROSME Swaziland*. IOSTE 12 Proceedings.

Ngcobo, M. S. F. (2011). Contexts preferred for use in mathematics by Swaziland high performing public schools' junior secondary learners, In fulfillment of the requirements for the Degree of Philosophiae Doctor in the Faculty of Education. University of the Western Cape, Bellville.

Nika, A.(2009). Lojerat e fatkeqesive. *Misfortune games*. Revista Klan. Retrieved July 22, 2009 from <http://www.revistaklan.com/material.php?id=836>

Nika, A. (2009). Gjume ne moshen e internetit. *Sleeping in the age of internet*. Revista Klan. Retrieved August 11, 2009 from <http://www.revistaklan.com/material.php?id=850>

Niss, M. N.(2007). Reflections on the state and trends in research on Mathematics teaching and learning: from here to utopia. In Lester, F. K. (Eds.) *Second handbook of research on mathematics teaching and learning* (pp.1293-1312). Charlotte, NC: National Council of Teachers of mathematics

Noctor, M., Stoney, S.&Stradling, R.(1992). *Financial Literacy*. A report prepared for the National Westminster Bank. London

Nunnally, J.O.(1978). *Psychometric theory*. New York: McGraw-Hill

OAU (1981). *Lagos Plan of Action for the Economic Development of Africa: 1980-2000* Lagos, Nigeria

OECD.(2001). *Knowledge and skills for life: First result from OECD programme for international students assessment (PISA) 2000*

OECD.(2004). *Learning for tomorrow's world: first results from PISA 2003*.

OECD (2006)

OECD (2010) *PISA 2009 Results: What Students Know and Can Do – Volume I*

OECD - *Invest in youth to tackle jobs crisis* -Retrieved from:
http://www.oecd.org/document/1/0,3746,en_21571361_44315115_46733377_1_1_1_1,00.html

Olds, T., Dollman, J., Ridley, K., Boshoff, K., Hartshone, S., &Kennaugh, S. (2004).
Children and Sport. Adelaide: Australian Government

Op'tEynde, P., De Corte, E., &Verschaffel, L. (2001). "What to learn from what we feel?":
The role of students' emotions in the mathematics classroom. In S. Volet& S. Järvelä
(Eds.), *Motivation in learning contexts:Theoretical advances and methodological
implications* (pp. 149-167). (Advances in Learning and Instruction Series.) Oxford, UK:
Elsevier Science

O'Toole, K.(1997). *Pop music at core of youth culture: Rock & Roll: Does it influence teens'
behavior?*Stanford Report, November 12, 1997. Retrieved on March 2011, from
<http://library.thinkquest.org/07aug/00811/music.html>

Paik, S-Y.(2004). Mathematics Curriculum in Korea.presented at the International Congress
on Mathematical Education (ICME)-10, July 4-11, 2004, Copenhagen, Denmark

Park, J.(2004a). Teacher, class teaching and achievement. Seoul: *Korean Institute of
Curriculum and Evaluation*

Park, J.(2004b). The international study on the trends changed in achievement of
mathematics and science. Seoul: *Korean Institute of Curriculum and Evaluation*

- Park, E-K.(2001). A study on children's about dance and participation. *Journal of HankukChodeung Dance Society*, 6
- Park, J-H.(1998). *The Saemaul movement: Korea's approach to rural modernization in 1970s*. Seoul: Korea Rural Economic Institute
- Park, Y-B.(2005). A Study on the Direction for the Development of Dance Sport in Korea.www.dawonmedia.co.kr/.../한국%20댄스스포츠의%20발전방향%20연구. hwp.p 25
- Patton, M.Q. (1990). *Qualitative Evaluation and Research Methods*, 2nd Edition. Sage Publications: Newbury Park, London
- Pawson, R. (2006). *Evidence based policy. A realist perspective*. Sage: London
- Pierce, R.& Stacey, K.(2006). Enhancing the image of mathematics by association with simple pleasures from real word contexts.*ZDM*, 38(3), 214-225
- Pigram, J.(1983). *Outdoor Recreation and Resource Management*. London: Croom Helm
- Pring, R. (2004). *Philosophy of Educational Research* (2nd edition). Continuum: London
- Rasch G. (1980). *Probabilistic models for some intelligence and attainment tests*. Chicago, IL: University of Chicago Press
- Raths, L.E., Harmin, M., & Simon, S.B. (1987). Selections from Values and Teaching. In P.F Carbone, (Ed.) *Value Theory and education* (pp. 198-214).Malabar, USA: Kreiger

- Reeves, B., & Fayers, P. (2005). *Applying item response theory modeling for evaluating questionnaire item and scale properties*. Oxford: Oxford University Press
- Renninger, K. A. (2000). How might the development of individual interest contribute to the conceptualization of intrinsic motivation? In C. Sansone and J. M. Harackiewicz (eds), *Intrinsic and extrinsic motivation: The search for optimal motivation and performance*. New York: Academic Press
- Renninger, K. A., & Hidi, S. (2002). Student interest and achievement: Developmental issues raised by a case study. In A. Wigfield & J. S. Eccles (Eds.), *Development of achievement motivation*. (pp. 173–195). New York: Academic
- Renninger, K. A., Hidi, S., Krapp, A. (1992). *The Role of interest in learning and development*. NJ: Lawrence Erlbaum Associates
- Rokeach, M. (1968). Teachers' Beliefs and Educational Research: Cleaning Up a Messy Construct *Review of Educational Research* 62, (3) (Autumn, 1992), 307-332
Published by: American Educational Research Association. Jstor retrieved 2012. 06.02
<http://www.jstor.org/stable/10.2307/1170741>
- Schagen, S., & Lines, A. (1996). *Financial Literacy in Adult Life: a Report to the NatWest Group Charitable Trust*. Slough, Berkshire: National Foundation for Educational Research.
- Schiefele, U. (1992). Topic interest and levels of text comprehension, in K. A. Renninger, S. Hidi, & A. Krapp (eds), *The role of interest in learning and development*. Hillsdale, NJ: Erlbaum
- Schreiner, Camilla (2006): Explore a ROSE-GARDEN pp.43-44.
- Schreiner, C. & Sjøberg, S. (2004). *Sowing the seeds of ROSE: Background, questionnaire development and data collection for ROSE (The Relevance of Science Education). A comparative view of students' views of science and science education*. Oslo: ILS og forfatteren

Schreiner, C., & Sjøberg, S. (2006). Science education and youth's identity construction—two incompatible projects? In D. Corrigan, Dillon, J. & Gunstone, R. (Eds.), *The Re-emergence of Values in the Science Curriculum*: Sense Publications (in progress)

Shin, H-O.(2004). *Mathematical education for children*. Seoul: Kyomunsa.

신현옥, 김동춘, 이수경, 김영숙, 류철선. *유아를 위한 수학교육*. 서울: 교문사

SIDA, ne me pak se njevitjane infektuar 30 persona. AIDS, in less than one year 30 persons are infected. (2008, December 1). Shqip. Retrieved July 10, 2009 from <http://www.gazeta-shqip.com/artikull.php?id=54531>

Sjøberg, S. (2000). *Science And Scientists: The SAS-study. Cross-cultural evidence and perspectives on pupils' interests, experiences and perceptions. Background, Development and Selected Results* (Web-version 28 May 2000).

Sjøberg, S. and Schreiner, C. (2010). The ROSE project An overview and key findings. Available at: <http://traces.fisica.unina.it/attachments/article/168/ROSE-Sjøberg-Schreiner-overview-2010-1.pdf> Accessed on 20 February 2013.

Snyders, C.J. (2006). A comparison between the contexts grade 10 learners prefer for Mathematical Literacy and those reflected in the TIMSS survey.

Special Plan Team of Webjin, (2007). Generation Empathy: know correctly youth culture! No 2. <http://www.einschool.com/entry/세대공감-청소년문화-지금부터-바로알자-2>

Steen, L. A. (1990). *On the shoulders of giants: New approaches to numeracy*. Washington, DC: National Academy Press

Strauss, A. L., & Corbin, J. M. (1990). *Basics of qualitative research: grounded theory procedures and techniques*. Sage: Newbury Park, California

Thistlewood, D. (1994). Herbert Read (1893–1968). Prospects: the quarterly review of comparative education. Paris, UNESCO: *International Bureau of Education*. 24, (1/2), 375–390

Thomas, R.(2009). *Plus, November 2009*. Retrieved on March 2011, from <http://plus.maths.org/content/career-interview-fashion-designer>

TUAC NEWS (2010).http://www.tuac.org/en/public/e-docs/00/00/08/11/document_news.phtml

Usiskin, Z. (1997). Applications in the secondary school mathematics curriculum: A generation of change. *American Journal of Education*, 106, 62-84.

Van Schalkwyk, G. P. (2007). *Context preference of teachers in South Africa and South Korea for mathematics in school*. A mini thesis submitted in partial fulfilment of the requirements for the M.Ed degree in the Faculty of Education, University of the Western Cape

Veal, A. J.(1992).Definitions of Leisure and Recreation. *Australian Journal of Leisure and Recreation*. 2(4), 44-48, 52

Villarrubia, B. (2001). Mathematics in Context (MiC). Encyclopaedia Britannica.Vol.10(2) 2006, pp. 49-58.

Von Clausewitz, C. (1982). *On war*. Penguin Books: London

Wedge, T. (1999). To know or not to know-Mathematics, that is a question of context. *Educational studies in Mathematics*, 39, 205-227

White, R. (1997) 'Young People, Waged Work and Exploitation', *Journal of Australian Political Economy* 40, 61-79

WHO.(2005). *Highlights on health. Albania*. Retrieved August 3, 2009 from http://www.euro.who.int/Albania/20080228_1

Williams, R. (1958).Moving from High Culture to Ordinary Culture. Originally published in N. McKenzie (ed.), *Convictions*, UK

- Wright, B.D. & Stone, M.H. (1979). *Best Test Design*. Chicago, IL: University of Chicago, MESA Press.
- White, R. (1997b). Young People, Waged Work and Exploitation', *Journal of Australian Political Economy* 40 (1997), pp 61-79.
- Yates, S. M. (2000). Student optimism, pessimism, motivation and achievement in mathematics: A longitudinal study. In T. Nakahara & M. Koyama (Eds.), *Proceedings of the 24th Conference of the International Group for the Psychology of Mathematics Education* (Vol. 4, pp. 297-304). Japan: Hiroshima University
- Yeom, H-W.(2008). High level in achievement in Maths and Science, low level in interest. YTN News. http://www.ytn.co.kr/_ln/0103_200812100022097312. (염해원 2008.10. 수학·과학 '성취도' 최상위권...'흥미도' 하위권.)
- Yoo, S-Y (2009). Develop interest for effective teaching compulsory subjects, Mathematics and Science. http://www.hellodd.com/Kr/DD_News/Article_View.asp?mark=28736 (유상영. 할수없이하는수학·과학교육, 흥미키워줘야. 대덕넷)
- Young, P. V. (1956). *Scientific social surveys and research: an introduction to the background, content, methods, principles, and analysis of social studies*. 3rd Ed. Englewood Cliffs, NJ: Prentice Hall.
- Zan, R. Brown, L., Evans, J. and Hannula, M. (2006). Affect in Mathematics Education: An Introduction. *Educational Studies in Mathematics*, October 2006, Volume 63, Issue 2, pp 113-121

APPENDICES

APPENDIX I (ENGLISH): ROSME II Questionnaire

CODE:.....



RELEVANCE OF SCHOOL MATHEMATICS EDUCATION (ROSME)II

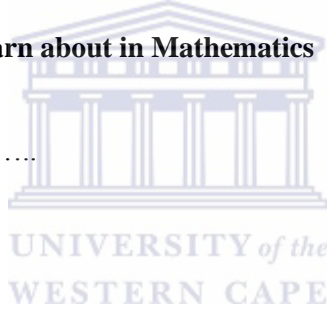
October 2008

Things I am interested to learn about in Mathematics

I am: a female a male

I am years old

I am in Grade



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

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

Examples:

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

My interest in learning about mathematics involved in						
CEx1		building houses is	Very high	High	Low X	Nil/Zero

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

My interest in learning about mathematics involved in						
CEx1		painting a car is	Very high X	High	Low	Nil/Zero

We thank you for your participation.

My interest in learning about mathematics involved in

C1	lotteries and gambling is	Very high	High	Low	Nil/Zero
C2	cultural products such as the house decorations made by Ndebele women is	Very high	High	Low	Nil/Zero
C3	the latest designer clothes is	Very high	High	Low	Nil/Zero
C4	secret codes such as pin numbers used for withdrawing money from an ATM is	Very high	High	Low	Nil/Zero
C5	agricultural matters is	Very high	High	Low	Nil/Zero
C6	government financial matters, such as inflation and taxes is	Very high	High	Low	Nil/Zero
C7	health matters such as the state of health of a person, the amount of medicine a sick person must take is	Very high	High	Low	Nil/Zero
C8	determining the level of development regarding employment, education and poverty of my community is	Very high	High	Low	Nil/Zero
C9	being productive with the doing of tasks in a job is	Very high	High	Low	Nil/Zero
C10	making computer games and storing music and videos on CD's and I-pods is	Very high	High	Low	Nil/Zero
C11	environmental issues and climate change is	Very high	High	Low	Nil/Zero
C12	determining the origin and age of the universe is	Very high	High	Low	Nil/Zero
C13	all kinds of pop music is	Very high	High	Low	Nil/Zero
C14	national and international politics is	Very high	High	Low	Nil/Zero
C15	dancing such as rave, disco and hip-hop is	Very high	High	Low	Nil/Zero
C16	sending and receiving of electronic messages such as SMS's and e-mails is	Very high	High	Low	Nil/Zero
C17	managing personal and business financial affairs is	Very high	High	Low	Nil/Zero
C18	recreation, physical exercise, sport activities and competitions is	Very high	High	Low	Nil/Zero
C19	responding to emergencies and disasters is	Very high	High	Low	Nil/Zero
C20	the spread and decline of epidemics such as AIDS; tuberculosis and cholera is	Very high	High	Low	Nil/Zero

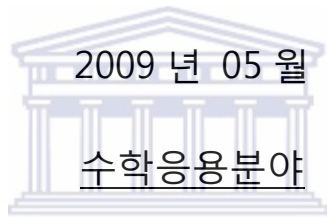
C21	planning a journey is	Very high	High	Low	Nil/Zero
C22	crime fighting, warfare and military matters is	Very high	High	Low	Nil/Zero
C23	construction and engineering	Very high	High	Low	Nil/Zero

APPENDIX I (KOREAN) ROSME II Questionnaire



코드:.....

학교수학교육관련성학생질문지



UNIVERSITY of the **나**이:
WESTERN CAPE

성별: 여남

학년: 중 2(8 학년), 중 3(9 학년), 고 1(10 학년)

이 문항지는 배우고 싶은 수학 응용 분야에 관한 질문지입니다. 각 항목마다 당신의 의견대로 네모 안에 있는 하나의 숫자에만 O 표를 하십시오 그리고 모든 항목에 다 답해 주십시오.

정답은 없습니다. 각 항목마다 솔직하게 당신이 좋아하는 것을 대답해 주십시오.

보기

당신이 "집짓기"에 관한 수학 응용 분야에 약간 관심이 있으면 아래와 같이 네모 칸 옆에 O 표를 해주 세요

내가 배우기를 원하는 수학 응용 분야					
보기 1	집짓기	아주 관심이 많음	관심이 많음	약관 관심이 있음(O)	전혀 관심이 없음

당신이“차질하기”에 관한수학응용분야에아주관심이많으면아래와같이네모칸옆에

○ 표를해주세요

내가배우기를원하는수학응용분야					
보기 2	차질하기	아주관심이많음(O)	관심이많음	약간관심이있음	전혀관심이없음

여러분의협조에감사드립니다

내가흥미있는수학응용분야는아래와같다

C1	복권과 도박에 관련된 수학	아주 관심이 많음	관심이 많음	약간 관심이 있음	전혀 관심이 없음
C2	옷과 같은 한국의 전통놀이에 관련한 수학	아주 관심이 많음	관심이 많음	약간 관심이 있음	전혀 관심이 없음
C3	최신식 옷 디자인에 관련된 수학	아주 관심이 많음	관심이 많음	약간 관심이 있음	전혀 관심이 없음
C4	현금 자동 인출기에서 돈을 인출하기위 해 쓰이는 비밀번호와 같은 비밀 코드와 관련된 수학	아주 관심이 많음	관심이 많음	약간 관심이 있음	전혀 관심이 없음
C5	농업에 관련된 수학	아주 관심이 많음	관심이 많음	약간 관심이 있음	전혀 관심이 없음
C6	물가상승,세금등과 같은 정부의 재정에 관한 수학	아주 관심이 많음	관심이 많음	약간 관심이 있음	전혀 관심이 없음
C7	사람의 건강 상태와 아픈 사람이 먹어야할 약의 양을 결정하는 건강에 관한 수학	아주 관심이 많음	관심이 많음	약간 관심이 있음	전혀 관심이 없음

C8	지역 공동 사회의 고용, 교육, 가난에 관한 개발의 수준을 결정하는데 관한 수학	아주 관심이 많음	관심이 많음	약간 관심이 있음	전혀 관심이 없음
C9	직업에 있어 생산성을 올리는데 관한 수학	아주 관심이 많음	관심이 많음	약간 관심이 있음	전혀 관심이 없음
C10	컴퓨터 게임을 만들고 CD 와 I POD 에 음악과 비디오를 저장하는데 관한 수학	아주 관심이 많음	관심이 많음	약간 관심이 있음	전혀 관심이 없음
C11	환경적인 문제와 기후 변화에 관련된 수학	아주 관심이 많음	관심이 많음	약간 관심이 있음	전혀 관심이 없음
C12	우주의 기원과 나이에 관한 수학	아주 관심이 많음	관심이 많음	약간 관심이 있음	전혀 관심이 없음
C13	모든 종류의 대중음악에 관련된 수학	아주 관심이 많음	관심이 많음	약간 관심이 있음	전혀 관심이 없음
C14	국내와 국제의 정치에 관한 수학	아주 관심이 많음	관심이 많음	약간 관심이 있음	전혀 관심이 없음
C15	Rave, 디스코, hip-hop 과 같은 춤에 관련된 수학	아주 관심이 많음	관심이 많음	약간 관심이 있음	전혀 관심이 없음
C16	문자 보내기와 이메일과 같은 전자 메시지를 주고 받는데 관한 수학	아주 관심이 많음	관심이 많음	약간 관심이 있음	전혀 관심이 없음
C17	개인과 사업의 재정적인 업무의 운영에 관한 수학	아주 관심이 많음	관심이 많음	약간 관심이 있음	전혀 관심이 없음
C18	오락, 신체 단련, 운동, 활동과 시합에 관련된 수학	아주 관심이 많음	관심이 많음	약간 관심이 있음	전혀 관심이 없음
C19	비상사태와 재해에 대처하는데 관한 수학	아주 관심이 많음	관심이 많음	약간 관심이 있음	전혀 관심이 없음
C20	에이즈, 결핵과 콜레라등의 전염병의 확산과 감소를 예상하는데 쓰이는 수학	아주 관심이 많음	관심이 많음	약간 관심이 있음	전혀 관심이 없음

C21	여행을 계획하는데 관련된 수학	아주 관심이 많음	관심이 많음	약간 관심이 있음	전혀 관심이 없음
C22	범죄 소탕, 전투와 군사문제들에 관한 수학	아주 관심이 많음	관심이 많음	약간 관심이 있음	전혀 관심이 없음
C23	건축과 공학에 관한 수학	아주 관심이 많음	관심이 많음	약간 관심이 있음	전혀 관심이 없음



APPENDIX II (KOREAN CARDS)

로또와도박



한국전통유희놀이와건축



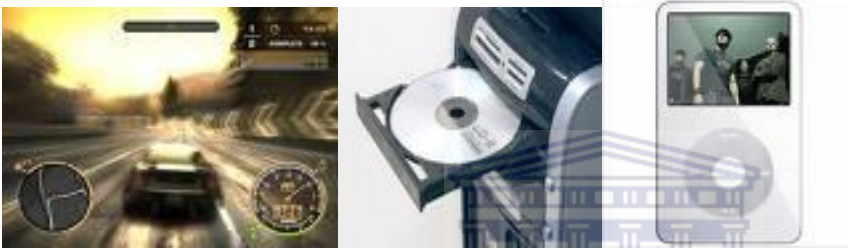
자동은행과같은사용을위한비밀번호



농업과 특수작용재배



컴퓨터게임, 시디에음악저장그리고아이팟



SMS 과이메일등을 통한 메시지 전송



금융, 재정 혹은 개인사업



APPENDIX IV(ENGLISH): Interview: main study

Sex: female, age: 16 years, grade: G9, code: mf1

interviewer: Place the seven cards in order of that which you like most to which you like the least to deal with in your mathematics classes

learner: I like follow order

1. computer games, storage of music on CD's and Ipods
2. lotteries and gambling.
3. sending of messages via SMS's and e-mails
4. secret codes such as PIN numbers to withdraw money from ATM's
5. Korean traditional games such as "yut"
6. farming and agricultural activities
7. personal finance and business finances

interviewer: Are you sure that you have laid out the cards is from what you prefer most to what you prefer least?

learner: yes

interviewer: I see that you have placed the one dealing with mathematics related to computer games, storage of music on CD's and Ipods, as the one you like the most, is this correct?

learner: yes

Interviewer: I see that you placed this one about computer games, storage of music on CD's and Ipods as one of contexts you like the most to deal with in your mathematics.

I: Why do you choose that card?

Because I am a student that I use electronic devices most, and in the future also I will use continuously so I want to learn and I want to know the most.

Interviewer: Which one do you use most?

Student:: computers, MP3, PMP (the features with all music and video playback, up to an electronic dictionary are a portable multi-media playback device.)

interviewer: I see that you have placed the one dealing with mathematics related to personal finance and business finances, as the one you least preferred, is this correct?

learner: yes

Interviewer: I see that you placed this one about personal finance and business finances

as one of contexts you least to deal with in your mathematics.

I: Why do you choose that card?

L: Personal finance and business finance, tax, etc. used in mathematics is usually too difficult, complex and those things come out graph so reluctant to learn.

interviewer: I see that you have placed the one dealing with mathematics related to secret codes such as PIN numbers to withdraw money from ATM's as the one you like in the middle, is this correct?

learner: yes

Interviewer: I see that you placed this one about computer games, storage of music on CD's and Ipods as one of contexts you like in the middle to deal with in your mathematics.

interviewer: Why do you choose that card?

learner:

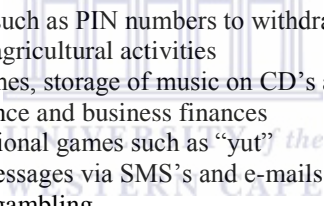
ATM that I used to put money and withdraw is useful because the password tell me the thing it will fit to me so I want to learn about that stuff.

If someone know your password? sensitive information and files will be leak that is important to me . What happens when information leakage? My information about me or anyone who has information about that kinds of information and he gets to know me threat or may be use my information

Sex: female, age:18 years, grade:G11, code: mf2

interviewer: Place the seven cards in order of that which you like most to which you like the least to deal with in your mathematics classes.

learner: I like follow order

- 
1. secret codes such as PIN numbers to withdraw money from ATM's
 2. farming and agricultural activities
 3. computer games, storage of music on CD's and Ipods
 4. personal finance and business finances
 5. Korean traditional games such as "yut"
 6. sending of messages via SMS's and e-mails
 7. lotteries and gambling.

interviewer: Are you sure that you have laid out the cards is from what you prefer most to what you prefer least?

learner: yes

interviewer: I see that you have placed the one dealing with mathematics related to secret codes such as PIN numbers to withdraw money from ATM's , as the one you like the most, is this correct?

learner: yes

Interviewer: I see that you placed this one about secret codes such as PIN numbers to withdraw money from ATM as one of contexts you like the most to deal with in your mathematics.

I: Why do you choose that card?

L: I want to know more about numbers, I would like to know the rules about password,

interviewer: I see that you have placed the one dealing with mathematics related to lotteries and gambling. , as the one you least preferred, is this correct?

learner: yes

Interviewer: I see that you placed this one about lotteries and gambling as one of contexts you least to deal with in your mathematics.

I: Why do you choose that card?

It is good to learn about probability in Mathematics dealing with lottery and gambling, but in real life, it results in violence and problems in the society because of money.

interviewer: I see that you have placed the one dealing with mathematics related to personal finance and business finances as the one you like in the middle, is this correct?

learner: yes

Interviewer: I see that you placed this one about personal finance and business finances as one of context you like in the middle to deal with in your mathematics.

interviewer: Why do you choose that card?

Learner: This subject seems to be related to stocks. Because I am not having an interest in stocks and money, to learn context about mathematics which is still related here, my interest is in the middle.

Interview

Sex: female, age: 18 years, grade: G11, code: mf3

interviewer: Place the seven cards in order of that which you like most to which you like the least to deal with in your mathematics classes

learner: I like follow order

1. personal finance and business finances
2. secret codes such as PIN numbers to withdraw money from ATM's
3. sending of messages via SMS's and e-mails lotteries and gambling.
4. Lotteries and gambling
5. computer games, storage of music on CD's and Ipods
6. Korean traditional games such as "yut"
7. farming and agricultural activities

interviewer: Are you sure that you have laid out the cards is from what you prefer most to what you prefer least?

learner: yes

interviewer: I see that you have placed the one dealing with mathematics related to personal finance and business finances, as the one you like the most, is this correct?

learner: yes

Interviewer: I see that you placed this one about as personal finance and business finances one of contexts you like the most to deal with in your mathematics.

I: Why do you choose that card?

L: if I become adult, I want to earn the money a lot, there will be interest a little about the stocks and also I will earn the money a lot, the possibility that I will spend money efficiently

If I become an adult, I would like to earn much money and have little interest in stocks because then there is possibility that I will spend money efficiently.

interviewer: I see that you have placed the one dealing with mathematics related to farming and agricultural activities, as the one you least preferred, is this correct?

learner: yes

Interviewer: I see that you placed this one about farming and agricultural activities as one of contexts you least to deal with in your mathematics.

I: Why do you choose that card?

L: About agriculture especially like the oceanic cultivation is not interest to me, as for that case the men will more be interested to be being and the more possibility the men doing is

About agriculture especially the oceanic cultivation, does not interest me. The men can do it better and will be more interested in it.

interviewer: I see that you have placed the one dealing with mathematics related to lotteries and gambling as the one you like in the middle, is this correct?

learner: yes

Interviewer: I see that you placed this one about lotteries and gambling as one of contexts you like in the middle to deal with in your mathematics.

interviewer: Why do you choose that card?

learner: sees from TV , the same case was caught from the lotteries and gambling, it cause family breakdown, although the news heard, sometimes I feel to play this lotteries and gambling.

When I watch the TV news I see people arrested for gambling and it causes family breakdown. Although when I listen to the news I feel motivated to play gambling and lotteries.

Interview

Sex: female, age: 16 years, grade: G9, code: mf4

interviewer: Place the seven cards in order of that which you like most to which you like the least to deal with in your mathematics classes

learner: I like follow order

1. lotteries and gambling.
2. computer games, storage of music on CD's and Ipods
3. sending of messages via SMS's and e-mails
4. personal finance and business finances
5. secret codes such as PIN numbers to withdraw money from ATM's
6. farming and agricultural activities
7. Korean traditional games such as "yut"

interviewer: Are you sure that you have laid out the cards is from what you prefer most to what you prefer least?

learner: yes

interviewer: I see that you have placed the one dealing with mathematics related to lotteries and gambling , as the one you like the most, is this correct?

learner: yes

Interviewer: I see that you placed this one about lotteries and gambling as one of contexts you like the most to deal with in your mathematics.

I: Why do you choose that card?

L: Because usually I enjoy card games

I: Why do you like a card game?

L: Trying to read the mind of different persons who like psychological games, common man see lotteries and gambling as negative a lot. I certainly do not have that kind of thought, as it is for leisure activity or a fun. With this mind set we can approach learners more easily mathematically.

interviewer: I see that you have placed the one dealing with mathematics related to Korean traditional games such as “yut”, as the one you least preferred, is this correct?

learner: yes

Interviewer: I see that you placed this one about Korean traditional games such as “yut” as one of contexts you least to deal with in your mathematics.

I: Why do you choose that card?

L: The traditional Korean plays are simple and enjoyable. It does not need to be taught mathematically. If it is approached mathematically it becomes tedious and there could be a possibility of rejection of that particular Korean play.

I: where the mathematics is used the case traditional play of Korea?

L: For example, when playing seesaw, the length and width of the board is calculated to know where the board can be positioned on the board holder to give a balance.

interviewer: I see that you have placed the one dealing with mathematics related to personal finance and business finances as the one you like in the middle, is this correct?

learner: yes

Interviewer: I see that you placed this one about personal finance and business finances as one of contexts you like in the middle to deal with in your mathematics.

interviewer: Why do you choose that card?

I have no private interest, in reality I do not need it now. However, it is not bad to teach the students in advance. This information is usually needed a lot especially when we become adult.

Individuals need personal finance, but later some students would need to study at the department of economics or business if they need business finance knowledge.

So, the interest which is personal excludes, the personal finance and business subject appear to be more important.

Interview

Sex: female, age: 16 years, grade: G9, code: mf5

interviewer: Place the seven cards in order of that which you like most to which you like the least to deal with in your mathematics classes

learner: I like follow order

1. farming and agricultural activities
2. personal finance and business finances
3. computer games, storage of music on CD's and Ipods
4. secret codes such as PIN numbers to withdraw money from ATM's
5. Korean traditional games such as "yut"
6. sending of messages via SMS's and e-mails
7. lotteries and gambling

interviewer: Are you sure that you have laid out the cards is from what you prefer most to what you prefer least?

learner: yes

interviewer: I see that you have placed the one dealing with mathematics related to farming and agricultural activities, as the one you like the most, is this correct?

learner: yes

Interviewer: I see that you placed this one about farming and agricultural activities as one of contexts you like the most to deal with in your mathematics.

I: Why do you choose that card?

L: Student: Because of the factories and buildings are built a lot, and the land is become insufficient for farming. Also the population extended and farming was more necessary. The use of Mathematics in that situation is important because it would make practical the use of land for cultivation more efficient and economical.

I: why do you think agriculture and special crops cultivation are important?

L: people must do farming in order to eat to live.

I: In your opinion what kind of agriculture is related to mathematics?

L: The land area which will cultivate many plants when a one line ground is raised.

interviewer: I see that you have placed the one dealing with mathematics related to lotteries and gambling , as the one you least preferred, is this correct?

learner: yes

Interviewer: I see that you placed this one about lotteries and gambling as one of contexts you least to deal with in your mathematics.

I: Why do you choose that card?

L: first of all I think that People must earn the money by personal effort. Also gambling is a very easily means to earn money instantaneous and rapidly, and is possibility of losing the money too, which may cause their family to collapse. People who earn large sums of money through gambling find it difficult resist the temptation of gambling.

What do you think is good about gambling and lotteries?

L: What I find good is that it is a psychological game that is interesting and has fun.

interviewer: I see that you have placed the one dealing with mathematics related to secret codes such as PIN numbers to withdraw money from ATM's as the one you like in the middle, is this correct?

learner: yes

Interviewer: I see that you placed this one about computer games, storage of music on CD's and Ipods as one of contexts you like in the middle to deal with in your mathematics.

interviewer: Why do you choose that card?

learner:: Because this part is good and the bad. The first point is that it is exactly in the middle portion. It is good because it is a password and a secret code etc. Even though there is possibilities of protecting information from lost, people wrongfully act on this mathematical device to commit capital robbery.

Interview

Sex: female, age: 17 years, grade: G10, code: mf6

interviewer: Place the seven cards in order of that which you like most to which you like the least to deal with in your mathematics classes

learner: I like follow order

1. personal finance and business finances
2. secret codes such as PIN numbers to withdraw money from ATM's
3. computer games, storage of music on CD's and Ipods
4. lotteries and gambling.
5. farming and agricultural activities
6. sending of messages via SMS's and e-mails
7. Korean traditional games such as "yut"

interviewer: Are you sure that you have laid out the cards is from what you prefer most to what you prefer least?

learner: yes

interviewer: I see that you have placed the one dealing with mathematics related to personal finance and business finances, as the one you like the most, is this correct?

learner: yes

Interviewer: I see that you placed this one about personal finance and business finances as one of contexts you like the most to deal with in your mathematics.

I: Why do you choose that card?

L: Usually, I have lots of interest in business economics and managements.

I: Why do you have lots of interest to the field?

L: According to general situation of the society, and to understand the relationship between people their financial interest.

I: What are your future dreams?

L: An accountant

I: Yes, that's good.

interviewer: I see that you have placed the one dealing with mathematics related to Korean traditional games such as "yut", as the one you least preferred, is this correct?

learner: yes

Interviewer: I see that you placed this one about Korean traditional games such as "yut"

as one of contexts you least to deal with in your mathematics.

I: Why do you choose that card?

L: Even in play ground, I don't want to bring in mathematical concepts into play.

I: That's right. If it is so, even this play ground, don't you think it is important to bring in mathematical concepts?

L: Seeing the baduk board, I think between Pythagorean theorem and Mathematical relation

I: Can you tell the relationship?

L: After fixing a right-angled triangle to transversal vertical in an arranged manner and in an interval it is being roughly fixed, to fit the size of the triangle.

interviewer: I see that you have placed the one dealing with mathematics related to lotteries and gambling as the one you like in the middle, is this correct?

learner: yes

Interviewer: I see that you placed this one about lotteries and gambling as one of contexts you like in the middle to deal with in your mathematics.

interviewer: Why do you choose that card?

L: If only the lotteries were in, I would put first on the top direction. If only the gambling was in, I would to put it to the very down direction. But they were together, I put to the center.

I: Do you think positively or negatively towards lotteries and gambling?

L: it is negative.

I: Why do you think negative?

L: People are to interested in materialism and they get too hung up to money which is unpleasant

I: If it is so, is there any positive point?

L: Money gained from gambling and lotteries increase purchasing power and help to increase economic activity.

L: Thanks

Sex: female, age: 18 years, grade: G11, code: mf7

Why do you like this theme most?

When I learn passwords or if I forget my passwords, I can find out. I like learning about password most because if people loss password or my neighbor forget password, I can assist them.

Why do you dislike this card?

Calculation is very complicated and makes me sick that is why I don't like.

If you are not interested about stocks, you don't need to learn it.

Why place the card in middle?

To sendSMSmessagesande-mail is neither easy nor is it difficult from the 7 cards'themes, so I put that in the middle. And to send e-mail may not really produce skill for future career use. So I put that on that position

Sex: female, age: 18 years, grade: G11, code: mf8

Why do you like this theme most?

I want to know more about money so that in the future if I begin a business I can make reference. That is why I want to learn mathematics first.

Why do you dislike this card?

It appears I will not be doing that in the future.

Why place the card in middle?

If I know a little that will be beneficial, so I placed it in the middle.

Sex: female, age: 18 years, grade: G11, code: mf9

Why do you like this theme most?

If somebody becomes the prize winner of a lottery ticket, they turn to have much money which gives them self-satisfaction.

Why do you dislike this card?

I don't have interest aboutthecultureswhichare disappearingfrom our tradition. or ourmemory.I may and may not be interested.

Why place the card in middle?

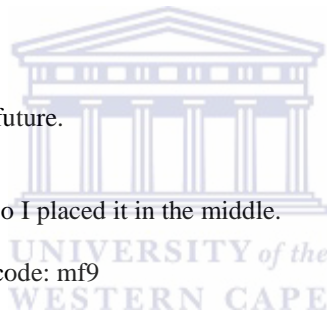
Middle interest

Sex: female, age: 18 years, grade: G11, code: mf10

Why do you like this theme most?

There are complex numbers. But if it does not involve me spending much money but a little money, I will like to know the trick.

Why do you dislike this card?



I am not interested in agriculture because I have stereotypes that women don't like farming. Farming seems to be useless to women. Farming is associated with food and it makes it important. Mathematical formula is complex and difficult and I must not make mistakes.

Why place the card in middle?

I don't know much about mathematical formula or mathematics itself that is why I am not interested. But we can use it in real life that is why I put it in the middle.

Sex: female, age: 16 years, grade: G9, code: mf11

Why do you like this theme most?

I frequently play computer games and store music on the computer. So I want to know why maths is used in saving information.

Don't you think CD will be use a lot?

The size is smaller than the growing capacity of information people seem to be writing. It will be useful to people receiving and providing information.

What do you think information is

I think I have learned in fact that knowledge helps to arranged material or compiled them.

Why do you dislike this card?

First of all the lottery ticket and gambling, is not a good conduct. Playing lottery ticket and gambling make one earn money easily and lose it easily. I think that it is wrong according to my opinion. One must work hard to must earn money. In my opinion, mathematics uses gambling and lottery ticket especially is not good. Gambling can lead instant bankruptcy. For example, people lose houses or lose all their money. It is not good to use mathematics in lottery and gambling because there cannot be 100% chance of winning.

Sex: female, age: 17 years, grade: G10, code: mf12

Q: Why do you like this theme most?

I have lots of interest in life science, so that makes me interested in agriculture. There is a possibility of cultivating effectively using mathematics.

Q: What is Life science?

It is the study of organisms and how they can be used to improve our lives.

Q: Why the life science will be effective to agriculture?

How can life science affect agriculture?

Grafting of organisms evolve in creates a possibility of developing agriculture

Q: Why do you dislike this card?

A: There is a big difference between the poor and the rich because of choice of number

Is it a problem if it is not addictive?

If it does not become addictive, that will be good. But a minority of adults becomes addictive and from that people suffer damages.

What kind of problems results from addiction?

It leads to loose of money, indebtedness and lose of lives.

What about mental effects?

The family may leave, causing feelings of loneliness and depression.

Q: Why do you place the card in middle?

A: I think there is great development in communication industry with big visions but this is not bigger than life science.

An industry that the attention gets recently with advancement of communication and the vision is high, but that industry has not higher vision than life science.

Q: What is vision?

The world is becoming nearer, and there is a possibility of becoming neighborhood?

How will life science be more important?

Life is more important

Sex: female, age: 16 years, grade: G10, code: mf13

Why do you like this theme most?

Learning through playing is easy and convenient. Also, with the development of the brain it appears to be much more helpful when learning mathematics.

What other traditional play other than the previous one?

There is air-stone play and Korea Circle dance.

Why do you dislike this card?

As usual there is no interest in this field. I think few talented people can learn.

Why place the card in middle?

Generally, though I am interested, that interest is not much. If I learn, I can gain in real life.

What are the things related to this field?

Computer and info-communication are related.

What mathematics programs are used for computer?

Binary system

Interview

Sex: male, age: 18 years, grade: G11, code: mm1

interviewer: Place the seven cards in order of that which you like most to which you like the least to deal with in your mathematics classes

learner: I like follow order

1. lotteries and gambling
2. personal finance and business finances
3. secret codes such as PIN numbers to withdraw money from ATM's
4. computer games, storage of music on CD's and Ipods
5. farming and agricultural activities
6. sending of messages via SMS's and e-mails
7. Korean traditional games such as "yut"

interviewer: Are you sure that you have laid out the cards is from what you prefer most to what you prefer least?

learner: yes

interviewer: I see that you have placed the one dealing with mathematics related to lotteries and gambling, as the one you like the most, is this correct?

learner: yes

Interviewer: I see that you placed this one about lotteries and gambling as one of contexts you like the most to deal with in your mathematics.

I: Why do you choose that card?

L: Because from childhood, I have had a lot of interest in gambling or card games like Black jack card game. Mathematical element determines a win or defeat in gambling. Gambling operates from imaginary points and I will like to know more about mathematical principles to understand gambling.

interviewer: I see that you have placed the one dealing with mathematics related to Korean traditional games such as "yut", as the one you least preferred, is this correct?

learner: yes

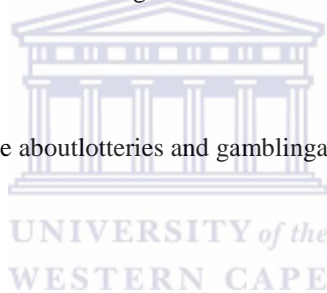
Interviewer: I see that you placed this one about to Korean traditional games such as "yut" as one of contexts you least to deal with in your mathematics.

I: Why do you choose that card?

L: Because through Traditional Korean play the possibility of learning mathematics is limited and may cause the effectiveness to disappear since such plays are not common these days.

interviewer: I see that you have placed the one dealing with mathematics related to computer games, storage of music on CD's and Ipods as the one you like in the middle, is this correct?

learner: yes



Interviewer: I see that you placed this one about computer games, storage of music on CD's and Ipods as one of contexts you like in the middle to deal with in your mathematics.

interviewer: Why do you choose that card?

Learner: Generally I am not interested in computer games, storage of music on CD's and Ipods. Fields like agriculture crops, SMS, e-mail, [yut] are also of least interest to me. They have least mathematical elements and principles.

Interview

Sex: male, age: 18 years, grade: G11, code: mm2

interviewer: Place the seven cards in order of that which you like most to which you like the least to deal with in your mathematics classes

learner: I like follow order

1. secret codes such as PIN numbers to withdraw money from ATM's
2. lotteries and gambling.
3. computer games, storage of music on CD's and Ipods
4. Korean traditional games such as "yut"
5. sending of messages via SMS's and e-mails
6. farming and agricultural activities
7. personal finance and business finances

interviewer: Are you sure that you have laid out the cards is from what you prefer most to what you prefer least?

learner: yes

interviewer: I see that you have placed the one dealing with mathematics related to secret codes such as PIN numbers to withdraw money from ATM's, as the one you like the most, is this correct?

learner: yes

Interviewer: I see that you placed this one about secret codes such as PIN numbers to withdraw money from ATM's as one of contexts you like the most to deal with in your mathematics.

I: Why do you choose that card?

L: Recently because of Ch'onan navy ship or spy problem, the national defense is becoming an issue. when we know well password and secret codes, it protects important information and national defense can keep those information.

Questioner: What do you understand about information?

In my opinion, as you know from automated teller machines, there appears to be the possibility of protecting once privacy.

interviewer: I see that you have placed the one dealing with mathematics related to personal finance and business finances, as the one you least preferred, is this correct?

learner: yes

Interviewer: I see that you placed this one about personal finance and business finances as one of contexts you least to deal with in your mathematics.

I: Why do you choose that card?

L: I am not able to manage money well and I am not interested in personal finance and business finances.

interviewer: I see that you have placed the one dealing with mathematics related to Korean traditional games such as “yut” as the one you like in the middle, is this correct?

learner: yes

Interviewer: I see that you placed this one about Korean traditional games such as “yut”

as one of contexts you like in the middle to deal with in your mathematics.

interviewer: Why do you choose that card?

Learner: I am interested a lot in electronic instrument and secret code which is above. I also have a little interest in Korean traditional games such as “yut” than the agriculture institutions established by law which is in the lower part.

Interview

Sex: male, age: 17 years, grade: G10, code: mm3

interviewer: Place the seven cards in order of that which you like most to which you like the least to deal with in your mathematics classes

learner: I like follow order

1. computer games, storage of music on CD's and Ipods
2. secret codes such as PIN numbers to withdraw money from ATM's
3. personal finance and business finances
4. lotteries and gambling.
5. sending of messages via SMS's and e-mails
6. Korean traditional games such as “yut”
7. farming and agricultural activities

interviewer: Are you sure that you have laid out the cards is from what you prefer most to what you prefer least?

learner: yes

interviewer: I see that you have placed the one dealing with mathematics related to computer games, storage of music on CD's and Ipods, as the one you like the most, is this correct?

learner: yes

Interviewer: I see that you placed this one about computer games, storage of music on CD's and Ipods as one of contexts you like the most to deal with in your mathematics.

I: Why do you choose that card?

Answer: Because of the possibility of using it in the future

I: Where can a semiconductor be used?

Answer: Factory or company

I: Can it be used in a space ship?

Answer: It can be used, but I don't know where it can be used?

interviewer: I see that you have placed the one dealing with mathematics related to farming and agricultural activities, as the one you least preferred, is this correct?

learner: yes

Interviewer: I see that you placed this one about farming and agricultural activities as one of contexts you least to deal with in your mathematics.

I: Why do you choose that card?

L: Is there any relation to mathematics?

Answer: It can be used when calculating an area surface.

I: Did you learn at the school?

Answer: When calculating the area of a figure

I: Do you know life science or genetic engineering?

Answer: I am not interested, so I don't know well.

interviewer: I see that you have placed the one dealing with mathematics related to lotteries and gambling as the one you like in the middle, is this correct?

learner: yes

Interviewer: I see that you placed this one about lotteries and gambling as one of contexts you like in the middle to deal with in your mathematics.

interviewer: Why do you choose that card?

lotteries and gambling are they good or bad?

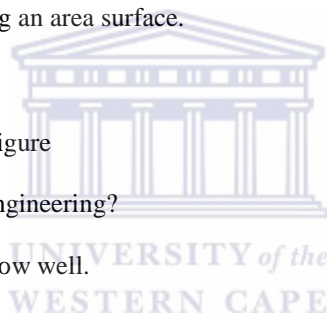
Answer: I think it is bad.

I: where is this related?

Answer: Probability

I: What point is good about it?

L: People can earn big money



I : What is the bad side it?

Answer: There is a possibility becoming abnormal in the mind which may result in lack of concern for the family.

Interview

Sex: male, age: 17 years, grade: G10, code: mm4

interviewer: Place the seven cards in order of that which you like most to which you like the least to deal with in your mathematics classes

learner: I like follow order

1. personal finance and business finances
2. farming and agricultural activities
3. computer games, storage of music on CD's and Ipods
4. Korean traditional games such as "yut"
5. sending of messages via SMS's and e-mails
6. secret codes such as PIN numbers to withdraw money from ATM's
7. lotteries and gambling.

interviewer: Are you sure that you have laid out the cards is from what you prefer most to what you prefer least?

learner: yes

interviewer: I see that you have placed the one dealing with mathematics related to personal finance and business finances, as the one you like the most, is this correct?

learner: yes

Interviewer: I see that you placed this one about personal finance and business finances

as one of contexts you like the most to deal with in your mathematics.

I: Why do you choose that card?

L: Because the prospects are high, and it is highly related to stocks, studies, engineering, making a product and also by knowing the price of the product.

I: What is a stock?

The value of an enterprises express in numbers.

interviewer: I see that you have placed the one dealing with mathematics related to lotteries and gambling., as the one you least preferred, is this correct?

learner: yes

Interviewer: I see that you placed this one about lotteries and gambling as one of contexts you least to deal with in your mathematics.

I: Why do you choose that card?

L: Because of gambling, I saw many people suffer loss

I: What does loss mean?

L: Mental loss and material loss

interviewer: I see that you have placed the one dealing with mathematics related to Korean traditional games such as “yut” as the one you like in the middle, is this correct?

learner: yes

Interviewer: I see that you placed this one about Korean traditional games such as “yut”

as one of contexts you like in the middle to deal with in your mathematics.

interviewer: Why do you choose that card?

learner: That is between necessity and unnecessary.

I: What is relation between mathematics and Korean traditional play?

L:- Traditional play remains the wisdom of the ancestors while traditional games includes mathematics.

- The example \Rightarrow Mathematics is used in the production of chair in the proper ratio so that it does not break.

\Rightarrow space ships (with Na Ro ship) =the mathematics is used to the turbo motors

Interview

Sex: female, age: 17 years, grade: G10, code: mm5

interviewer: Place the seven cards in order of that which you like most to which you like the least to deal with in your mathematics classes

learner: I like follow order

1. Korean traditional games such as “yut”
2. personal finance and business finances
3. secret codes such as PIN numbers to withdraw money from ATM's
4. lotteries and gambling.
5. computer games, storage of music on CD's and Ipods
6. sending of messages via SMS's and e-mails
7. farming and agricultural activities

interviewer: Are you sure that you have laid out the cards is from what you prefer most to what you prefer least?

learner: yes

interviewer: I see that you have placed the one dealing with mathematics related to Korean traditional games such as “yut” , as the one you like the most, is this correct?

learner: yes

Interviewer: I see that you placed this one about Korean traditional games such as “yut” as one of contexts you like the most to deal with in your mathematics.

I: Why do you choose that card?

L: People will find Korean traditional games such as “yut” to be easy and fun, while at the same time studying mathematical principle through “yut”

I: What if the traditional play exclude “yut”, Korean seesaw (using piece of board), and an elastic string play? What kind of mathematical principle is included?

L: There is a shuttlecock game. Shuttlecock game will be able to apply to principle of motion of projectile ascended to location of highest point, also about the reason which did not ascend any more there is a possibility of searching.

interviewer: I see that you have placed the one dealing with mathematics related to farming and agricultural activities, as the one you least preferred, is this correct?

learner: yes

Interviewer: I see that you placed this one about farming and agricultural activities as one of contexts you least to deal with in your mathematics.

I: Why do you choose that card?

L: I don't know about the use of mathematics in agriculture and special crops cultivation and special crops oceanic cultivation, also, recently I think that learners don't have interest about agriculture.

interviewer: I see that you have placed the one dealing with mathematics related to lotteries and gambling. as the one you like in the middle, is this correct?

learner: yes

Interviewer: I see that you placed this one about lotteries and gambling as one of contexts you like in the middle to deal with in your mathematics.

Interviewer: Why do you choose that card?

L: lotteries and the gambling hit the big fortune or become the biggest losers.

If there is a big fortune, it mean that people used mathematics well in the lotteries and gambling and there is possibility that the principles have been well mastered such that they can pass on the principles different persons to help each other. If there is a big loss, people can't get anything, they even lose property and became burglars.

Interview

Sex: male, age: 14 years, grade: G9, code: mm6

interviewer: Place the seven cards in order of that which you like most to which you like the least to deal with in your mathematics classes

learner: I like follow order

1. lotteries and gambling.
2. secret codes such as PIN numbers to withdraw money from ATM's
3. personal finance and business finances
4. sending of messages via SMS's and e-mails
5. farming and agricultural activities

6. computer games, storage of music on CD's and Ipods

7. Korean traditional games such as "yut"

interviewer: Are you sure that you have laid out the cards is from what you prefer most to what you prefer least?

learner: yes

interviewer: I see that you have placed the one dealing with mathematics related to lotteries and gambling., as the one you like the most, is this correct?

learner: yes

Interviewer: I see that you placed this one about lotteries and gambling .as one of contexts you like the most to deal with in your mathematics.

I: Why do you choose that card?

L: In the lotteries and gambling specially the gamblingputting much money is not good. Through thinking many probabilities could be of advantage.

I: Why are you interested a lot in that field?

L: It does not only use mathematics, but also uses other parts.

Interviewer: I see that you have placed the one dealing with mathematics related to Korean traditional games such as "yut", as the one you least preferred, is this correct?

learner: yes

Interviewer: I see that you placed this one about Korean traditional games such as "yut" as one of contexts you least to deal with in your mathematics.

I: Why do you choose that card?

L:It seems to have no relationship with mathematics. I think "yut' is just a play.

Interviewer: I see that you have placed the one dealing with mathematics related to sending of messages via SMS's and e-mails as the one you like in the middle, is this correct?

learner: yes

Interviewer: I see that you placed this one about sending of messages via SMS's and e-mails as one of contexts you like in the middle to deal with in your mathematics.

interviewer: Why do you choose that card?

L: Info-communication relating is a fun

Sex: male, age: 18 years, grade: G11, code: mm7

Why do you like this theme most?

There is little possibility of predicting the future, thus, selecting a route using a mathematical method will be the

most optimum.

Why do you dislike this card?

There is little connection in relation to my future career. I think that I have interest that is not useful.

Why place the card in middle?

With my interest in lottery ticket, gambling, personal finance and business finance which are closely related, I want to also learn about character service and computer in the future.

Sex: male, age: 18 years, grade: G11, code: mm8

Why do you like this theme most?

Lottery and gambling is about mathematical probability. If I play lottery or gambling, the chances that I will win are small because mathematics is not luck. And even to the probability of it being used in selecting society's and company stocks in economic sectors is very useful.

Why do you dislike this card?

When I saw the current status of the school in the fields of personal finance and business finance, I think that it is least useful. When I saw the current status of the school in the fields of personal finance and business finance, I think that it is most useful.

As student there are rear opportunities to handle money or control money. And calculating money at this moment I will avoid because it is complicated. But in the future it will be very useful

Why place the card in middle?

The reason why I placed sending text messages via SMS and email in the middle is because I am more interested in the previous fields when sending messages or e-mail. I do not know about SMS and email principles. However, it is good to learn it mathematically.

Sex: male, age: 18 years, grade: G11, code: mm9

Why do you like this theme most?

My father's job deals with computer programming which influence me to be exposed to the computer very early and made me to be interested in my father's career. Especially when the game is in connection with the complexities of the various elements that work together as a system and learning it will assist me a lot.

Why do you dislike this card?

On the side of agriculture, I do not have much interest or curiosity. I don't even know much about agriculture. Due to the tendency of preferences these days, through the internet I can get information about healthy food, organic food. So I believe it is not very useful.

Why place the card in middle?

I do not have much interest in the items below. I am interested in the upper items and their degree of usefulness. However, I think that gambling is my biggest concern though I think that it will not be useful so I placed it in the middle.

mm10

Sex: male, age: 16 years, grade: G9, code: mm10

Why do you like this theme most?

In the future, when I manage money, there will be a possibility of managing it efficiently by investing in stock of the enterprise.

What does it mean to invest efficiently?

I think that the overuse of money will lead to lack of money. In other to prepare for the future it is good to save money.

Do you have in mind to in enterprise?

If economically I realize a surplus, there will always be a thought to invest that money in property.

Can you tell me “what are stocks”?

I know that investing in an enterprise is to gain interest at the end.

Why do you dislike this card?

There is little sense of satisfaction and pleasure which is the possible feeling after work is done. And in the future I don't have in mind to work in that profession.

“Why don't you like that field”?

I dislike it and I don't have interest in the card.

Why place the card in middle?

As usual the cellular phone is used for exchanging email letters but I don't think that I have a deep relationship with that in life.

Don't you think this field will be useful in the future?

I think that the world has become a one village through which the exchange of information has become active and useful.

Sex: male, age: 15 years, grade: G9, code: mm11

Why do you want to learn No.1 ?”

The probability of playing the game scissor rock step [yut] in everyday life with friends appears to be used frequently and in many situations.

What is probability?

Probability is one of the possibilities that an event will be happening.

Why do you dislike this card?

Taking out money from the automated teller machine (ATM) or to know secrete code, I am not to familiar with that.

What have you heard about information?

In the future information will occupy a bigger portion life

Can satellite be used be used to transfer messages?

Even though satellite can be used to transfer messages, I don't want to learn because it is complicated.

Why did you put it in the middle?

Although I use message transport sector system frequently, for some reason it appears to be complicated.

Sex: male, age: 17 years, grade: G11, code: mm12

Why do you like this theme most?

Text message or email which I am I write will be able to report contents marvelously through invisible routes

Questioner: How is this used in real life?

It is used in sending and receiving text message to the friend, connects people who are in the different country, sends thee-mail each other, or transfer photograph images through satellite.

Why do you dislike this card?

To learn old traditional play is boring. I think that mathematics is not related in this traditional plays.

Questioner: Do you know what is the traditional playing game which related Mathematics?

Student: I know the "Chilkyo" play.

Questioner: What is "Chilkyo" play?

It uses a triangle and the quadrilateral is played which makes different kinds of forms.

Questioner: Is it related to geometry?

Student: Yes it is

Why did you put it in the middle?

Inserting a secret code into the machine and is accepted is marvelous but I don't have a lot of interest in the principle.

